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Ride-On Trowels

CRT 36-24A
CRT 48-31V
CRT 48-31V-ES

REPAIR MANUAL

This manual covers machines with Item Number:

0009086, 0009216, 0009232, 0009481, 0009482, 0009483

Operating / Parts Information

You must be familiar with the operation of this machine before you attempt to troubleshoot or repair it. Basic operating and maintenance procedures are described in the Operator's Manual supplied with the machine. Keep a copy of the Operator's Manual with the machine at all times. Use the separate Parts Book supplied with the machine to order replacement parts. If you are missing either of the documents, please contact Wacker Corporation to order a replacement.

Damage caused by misuse or neglect of the unit should be brought to the attention of the operator to prevent similar occurrences from happening in the future.

This manual provides information and procedures to safely repair and maintain the above Wacker model(s). For your own safety and protection from injury, carefully read, understand, and observe all instructions described in this manual. THE INFORMATION CONTAINED IN THIS MANUAL IS BASED ON MACHINES MANUFACTURED UP TO THE TIME OF PUBLICATION. WACKER CORPORATION RESERVES THE RIGHT TO CHANGE ANY PORTION OF THIS INFORMATION WITHOUT NOTICE.

CALIFORNIA

Proposition 65 Warning:

WARNING

Engine exhaust, some of its constituents, and certain vehicle components, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

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Laws Pertaining to Spark Arresters

Notice: State Health Safety Codes and Public Resources Codes specify that in certain locations spark arresters be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose.

In order to comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

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1. Safety Information

This manual contains DANGER, WARNING, CAUTION, and NOTE callouts which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION: Used without the safety alert symbol, CAUTION indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Note: *Contains additional information important to a procedure*.

1.1 Operating Safety

WARNING

Familiarity and proper training are required for the safe operation of equipment. Equipment operated improperly or by untrained personnel can be dangerous. Read the operating instructions contained in both this manual and the engine manual and familiarize yourself with the location and proper use of all controls. Inexperienced operators should receive instruction from someone familiar with the equipment before being allowed to operate the machine.

1.1.1 NEVER operate this machine in applications for which it is not intended.

1.1.2 NEVER allow anyone to operate this equipment without proper training. People operating this equipment must be familiar with the risks and hazards associated with it.

1.1.3 NEVER touch the engine or muffler while the engine is on or immediately after it has been turned off. These areas get hot and may cause burns.

1.1.4 NEVER use accessories or attachments that are not recommended by Wacker. Damage to equipment and injury to the user may result.

1.1.5 NEVER operate the machine with the beltguard missing. Exposed drive belt and pulleys create potentially dangerous hazards that can cause serious injuries.

1.1.6 NEVER leave machine running unattended.

1.1.7 DO NOT run the machine indoors or in an enclosed area such as a deep trench unless adequate ventilation, through such items as exhaust fans or hoses, is provided. Exhaust gas from the engine contains poisonous carbon monoxide gas; exposure to carbon monoxide can cause loss of consciousness and may lead to death.

1.1.8 ALWAYS remain aware of moving parts and keep hands, feet, and loose clothing away from the moving parts of the equipment.

1.1.9 ALWAYS wear protective clothing appropriate to the job site when operating equipment.

1.1.10 ALWAYS read, understand, and follow procedures in the Operator's Manual before attempting to operate the equipment.

1.1.11 ALWAYS be sure operator is familiar with proper safety precautions and operation techniques before using machine.

1.1.12 ALWAYS close fuel valve on engines equipped with one when machine is not being operated.

1.1.13 ALWAYS store the equipment properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children.

1.1.14 ALWAYS operate the machine with all safety devices and guards in place and in working order.

1.2 Operator Safety while using Internal Combustion Engines

DANGER

Internal combustion engines present special hazards during operation and fueling. Read and follow the warning instructions in the engine owner's manual and the safety guidelines below. Failure to follow the warnings and safety guidelines could result in severe injury or death.

1.2.1 DO NOT run the machine indoors or in an enclosed area such as a deep trench unless adequate ventilation, through such items as exhaust fans or hoses, is provided. Exhaust gas from the engine contains poisonous carbon monoxide gas; exposure to carbon monoxide can cause loss of consciousness and may lead to death.

1.2.2 DO NOT smoke while operating the machine.

1.2.3 DO NOT smoke when refueling the engine.

1.2.4 DO NOT refuel a hot or running engine.

1.2.5 DO NOT refuel the engine near an open flame.

1.2.6 DO NOT spill fuel when refueling the engine.

1.2.7 DO NOT run the engine near open flames.

1.2.8 ALWAYS refill the fuel tank in a well-ventilated area.

1.2.9 ALWAYS replace the fuel tank cap after refueling.

1.2.10 ALWAYS keep the area around the muffler free of debris such as leaves, paper, cartons, etc. A hot muffler could ignite the debris and start a fire.

1.3 Service Safety

WARNING

Poorly maintained equipment can become a safety hazard! In order for the equipment to operate safely and properly over a long period of time, periodic maintenance and occasional repairs are necessary.

1.3.1 DO NOT attempt to clean or service the machine while it is running. Rotating parts can cause severe injury.

1.3.2 DO NOT crank a flooded engine with the spark plug removed on gasoline-powered engines. Fuel trapped in the cylinder will squirt out the spark plug opening.

1.3.3 DO NOT test for spark on gasoline-powered engines if the engine is flooded or the smell of gasoline is present. A stray spark could ignite the fumes.

1.3.4 DO NOT use gasoline or other types of fuels or flammable solvents to clean parts, especially in enclosed areas. Fumes from fuels and solvents can become explosive.

1.3.5 ALWAYS turn engine off and remove key from machine before performing maintenance or making repairs.

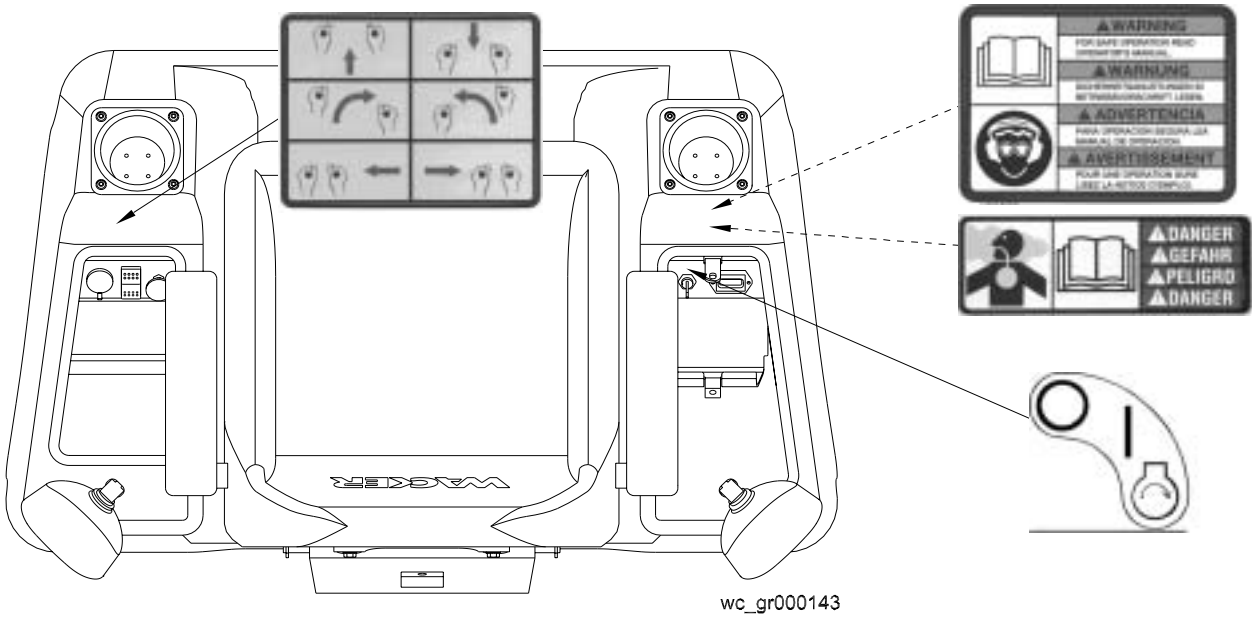
1.3.6 ALWAYS handle blades carefully. The blades can develop sharp edges which can cause serious cuts.

1.3.7 ALWAYS replace worn or damaged components with spare parts designed and recommended by Wacker Corporation.

1.3.8 ALWAYS disconnect the spark plug on machines equipped with gasoline engines, before servicing, to avoid accidental start-up.

1.3.9 ALWAYS keep the machine clean and labels legible. Replace all missing and hard-to-read labels. Labels provide important operating instructions and warn of dangers and hazards.

1.4 Label Locations—CRT 36



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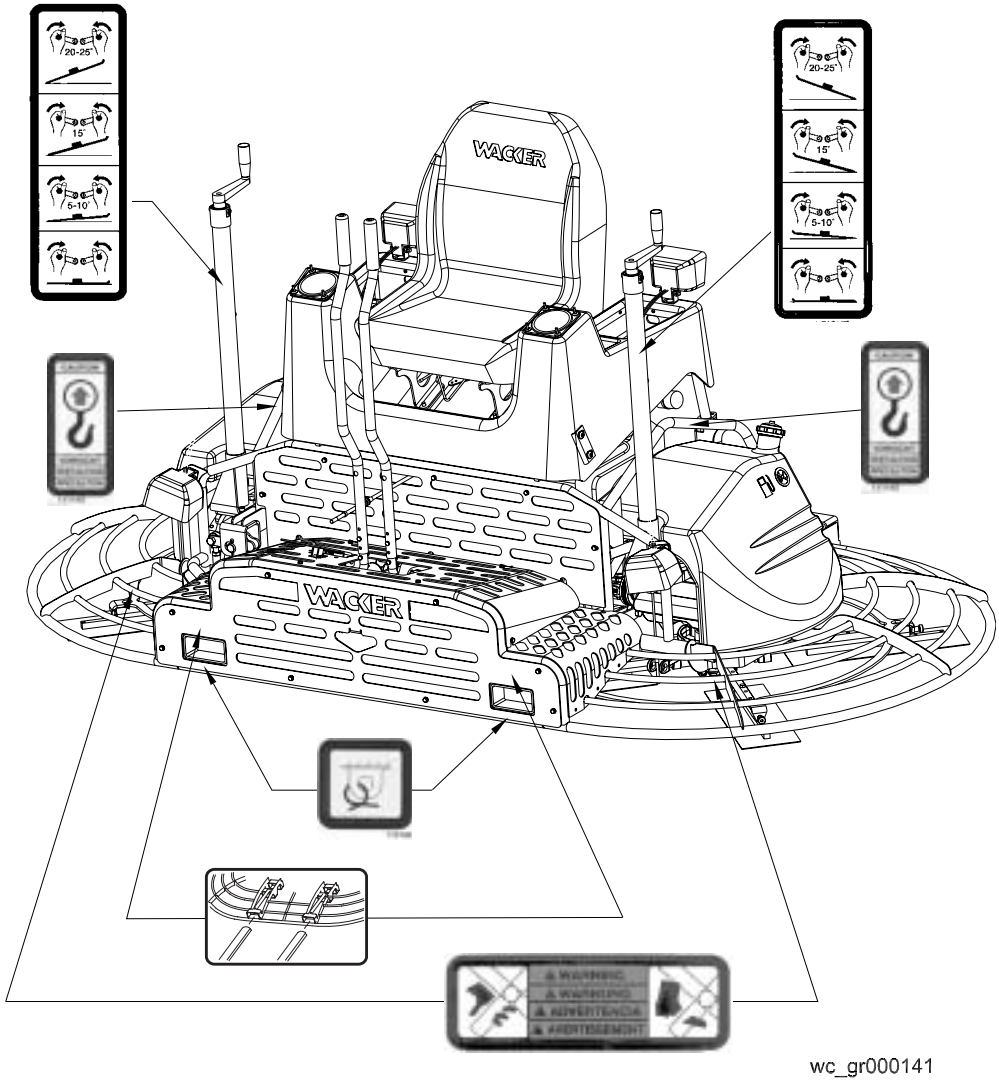
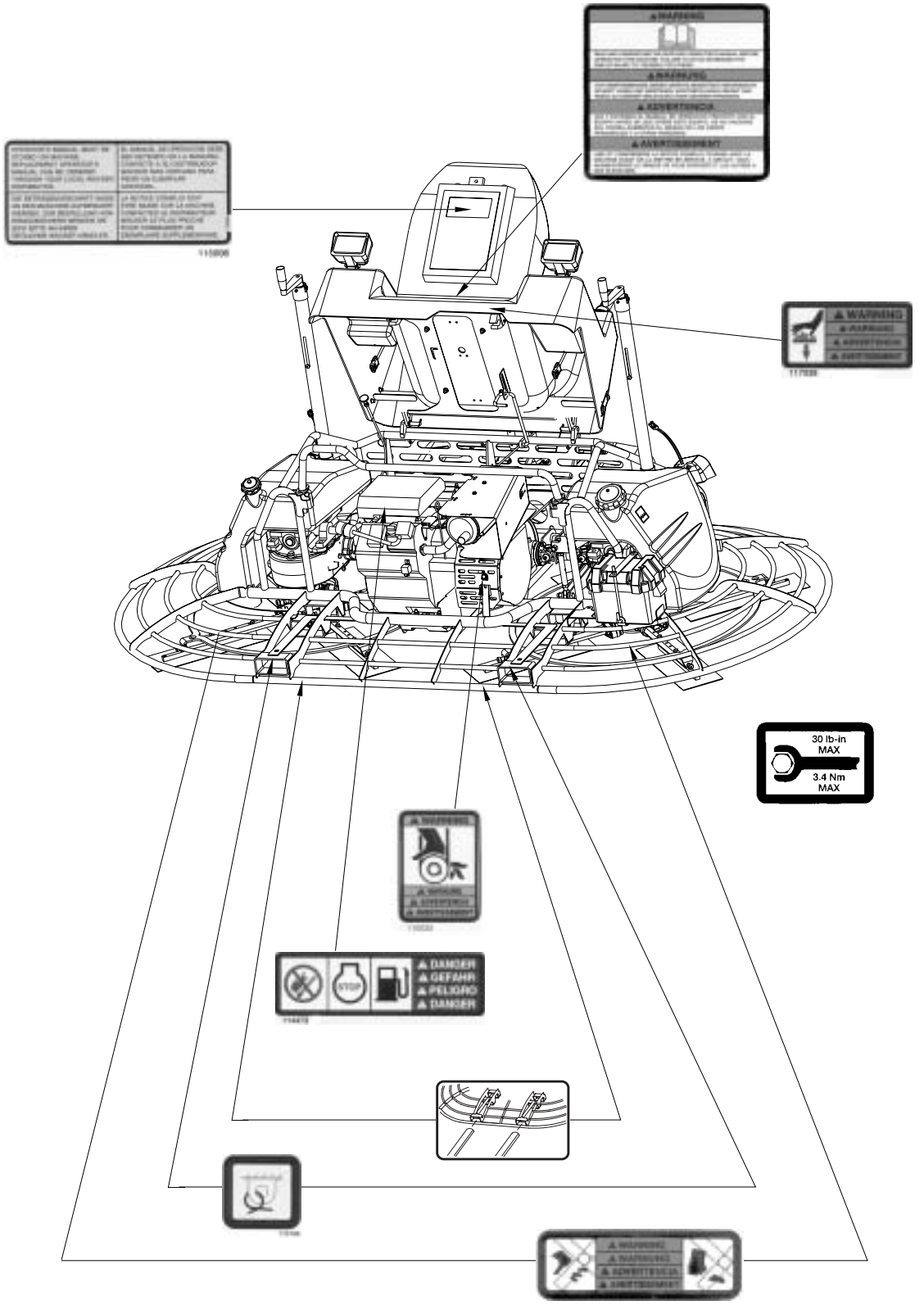
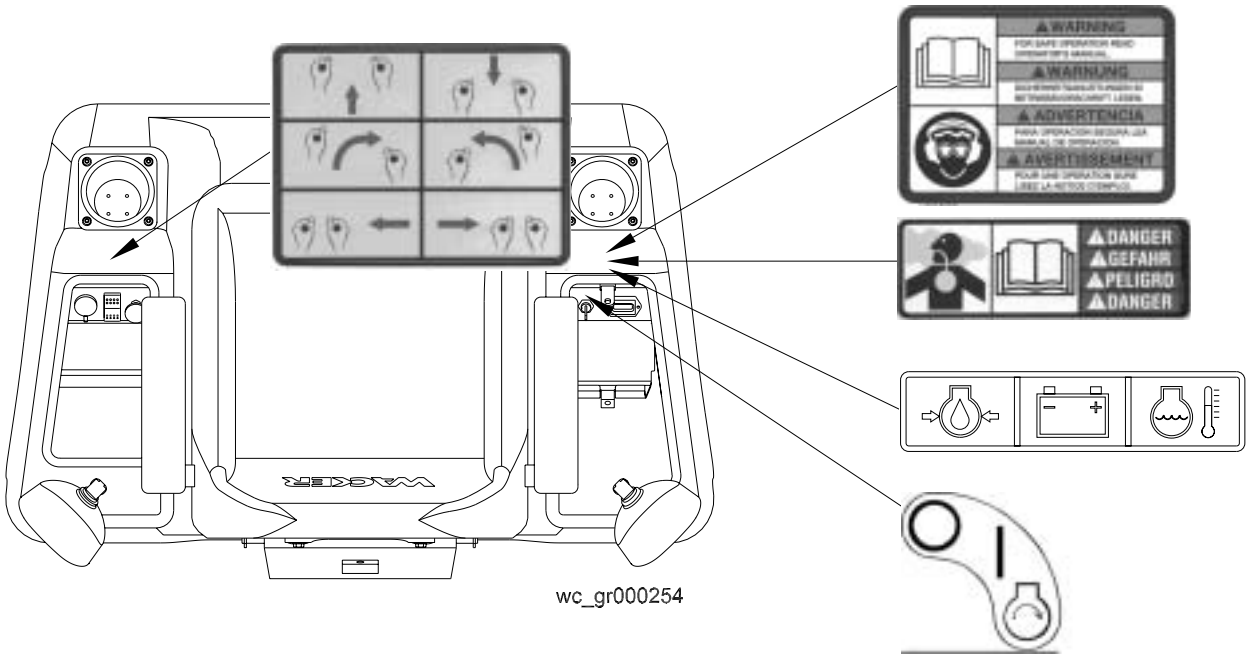


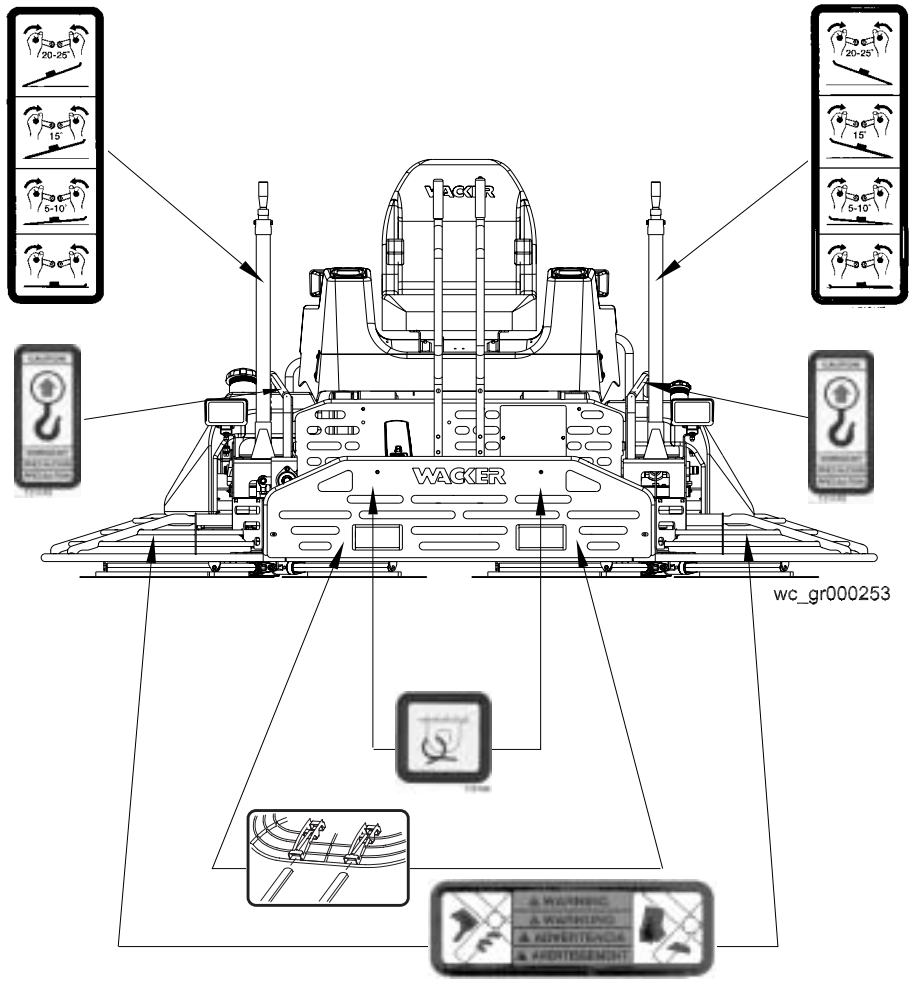
wc_gr000141

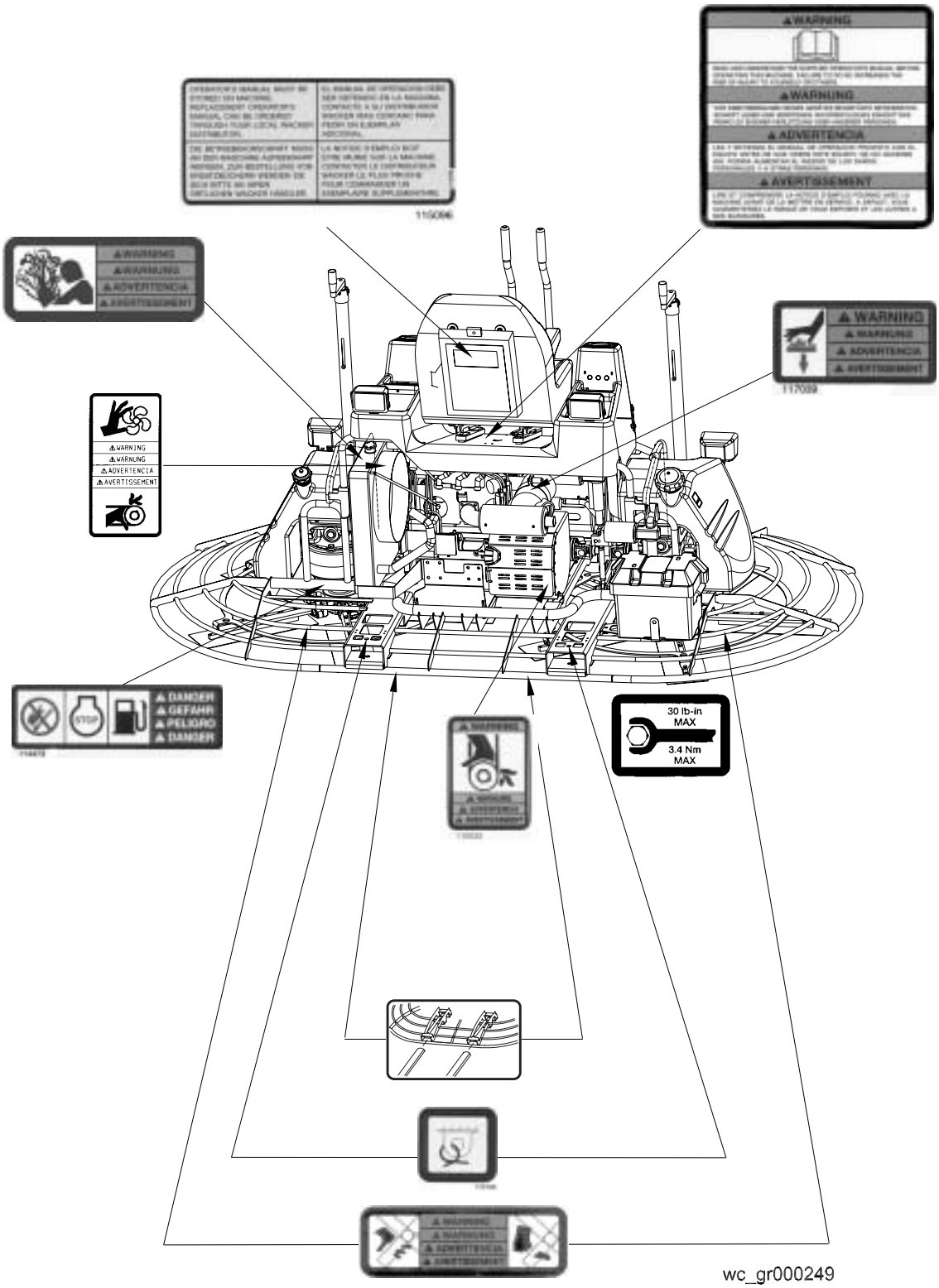


wc_gr000140

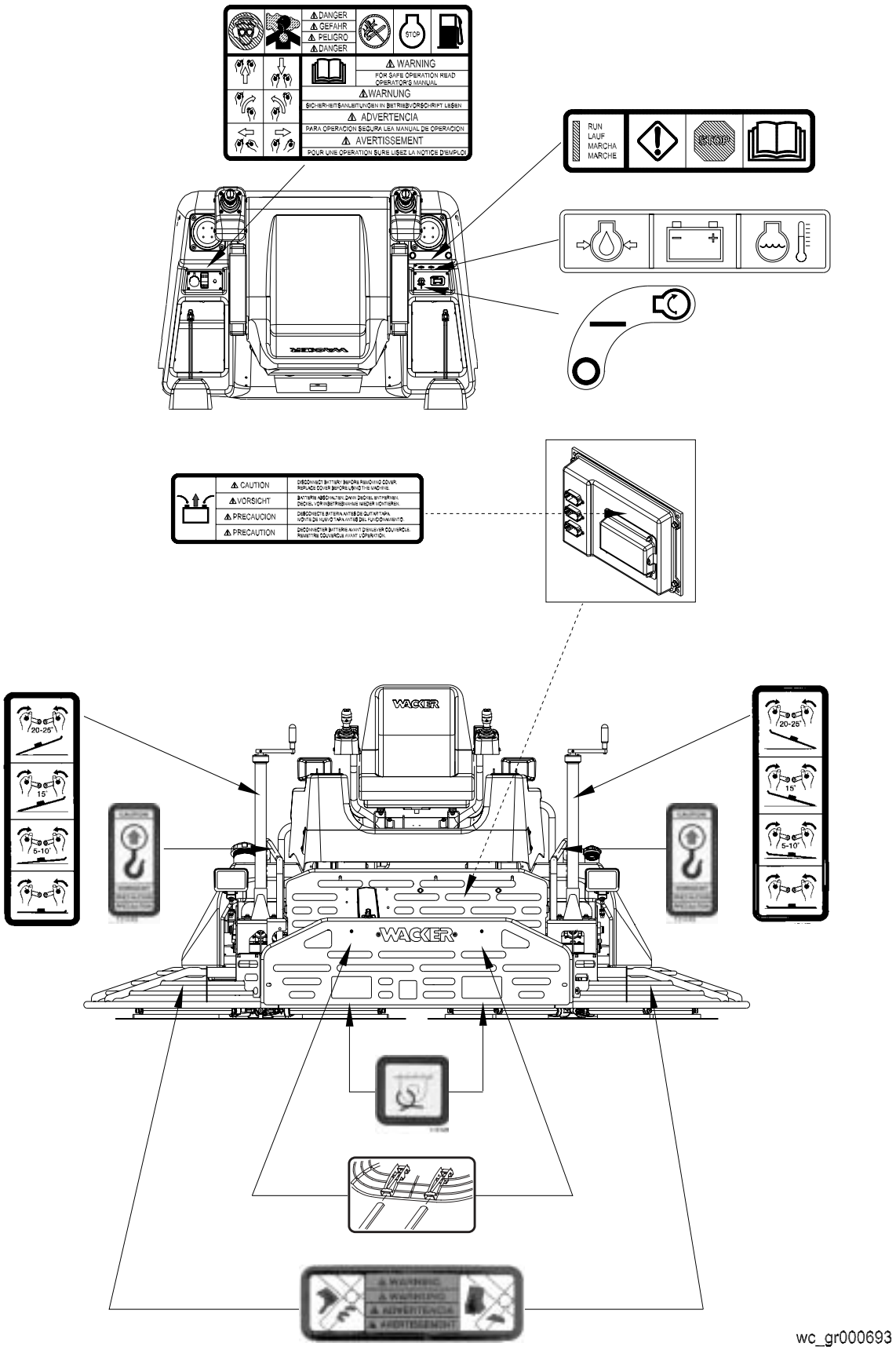
1.5 Label Locations—CRT 48 (manual steer)



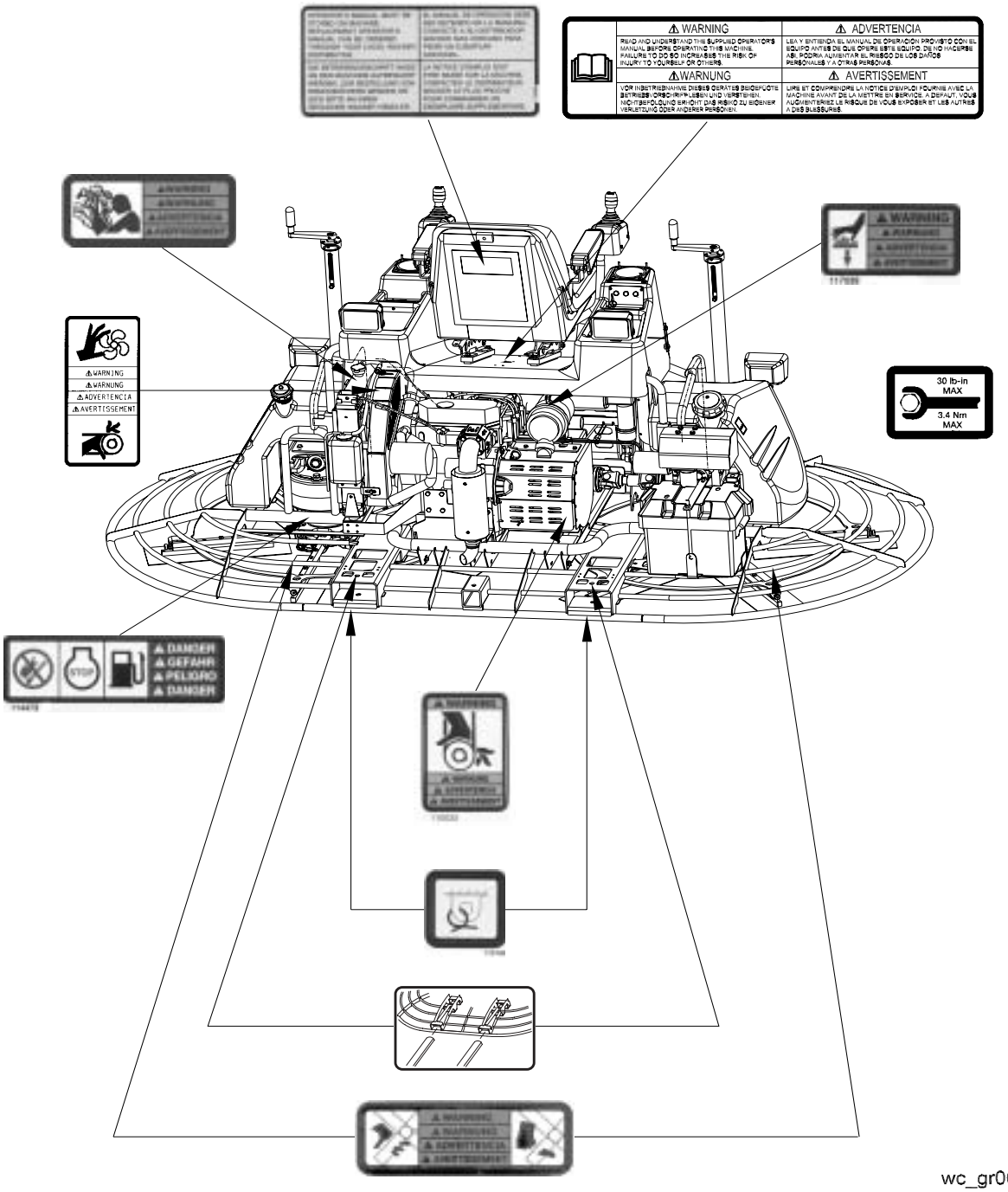



WARNING
WARNUNG
ADVERTENCIA
AVERTISSEMENT
DANGER
GEFAHR
PELIGRO
DANGER
30 lb-in MAX
3.4 Nm MAX
wc_gr000249

1.6 Label Locations—CRT 48 (electric steer)



wc_gr000693

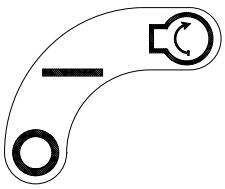
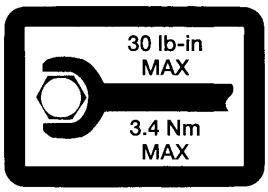

WARNING
ADVERTENCIA
READ AND UNDERSTAND THE SUPPLIED OPERATOR'S MANUAL BEFORE OPERATING THIS MACHINE. FAILURE TO DO SO INCREASES THE RISK OF INJURY TO YOURSELF OR OTHERS.
LEA Y ENTIENDA EL MANUAL DE OPERACIÓN PROVISTO CON EL EQUIPO ANTES DE QUE OPERE ESTE EQUIPO. DE NO HACERSE ASÍ, PODRÍA AUMENTAR EL RIESGO DE LOS DAÑOS PERSONALES Y A OTRAS PERSONAS.
WARNUNG
AVERTISSEMENT
VOR INBETRIEBNAHME DIESES GERÄTES BEDIENUNGSANLEITUNG LESEN UND VERSTEHEN. NICHTBEFOLGUNG ERHÖHT DAS RISIKO ZU EIGENER VERLETZUNG ODER ANDERER PERSONEN.
LIRE ET COMPRENDRE LA NOTICE D'EMPLOI FOURNIE AVEC LA MACHINE AVANT DE LA METTRE EN SERVICE. À DÉFAUT, VOUS AUGMENTERIEZ LE RISQUE DE VOUS EXPOSER ET LES AUTRES À DES BLESSURES.
30 lb-in MAX
3.4 Nm MAX
DANGER
GEFAHR
PELIGRO
DANGER
STOP

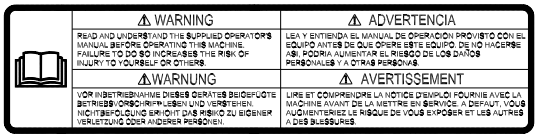
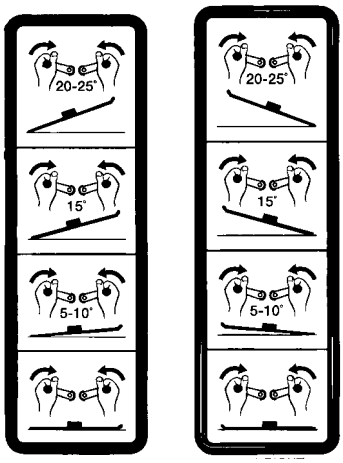
wc_gr000694

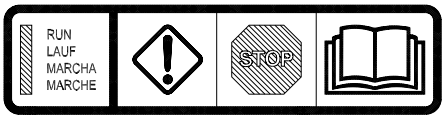
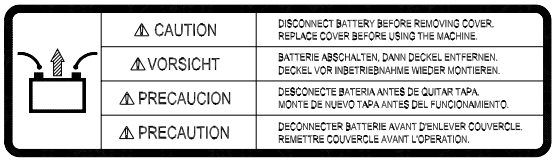
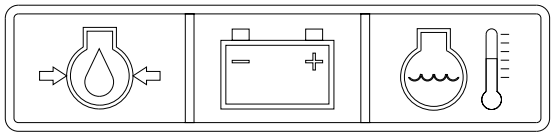
1.7 Safety and Operating Labels

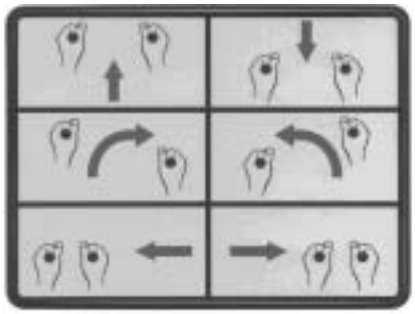
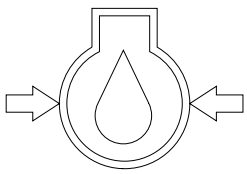
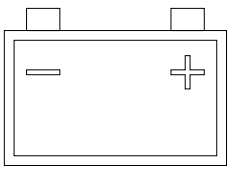
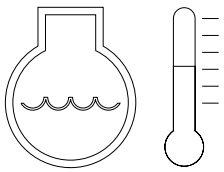
Wacker machines use international pictorial labels where needed. These labels are described below:

Label	Meaning
	DANGER! No sparks, flames or burning objects near machine.
	CAUTION! Use only clean, filtered gasoline fuel.
	Water tank fill. Use only clean water or water-based retardants.
	WARNING! Hot surface!
	DANGER! Engines emit carbon monoxide; operate only in well-ventilated area. Read the Operator's Manual. No sparks, flames, or burning objects near the machine. Shut off the engine before refueling. Steering control. Refer to section *Steering.*
	DANGER! Before fueling, stop the engine. No sparks, flames, or burning objects near the machine.

Label	Meaning
	WARNING! Cutting hazard. Always replace blade guard!
	WARNING! Pressurized contents. Do not open when hot!
	WARNING! Hand injury if caught in moving belt. Always replace beltguard.
	CAUTION! Lifting point
	Tie-down point
	Key switch, engine start: Off On Start
	Torque battery hold down nuts to 3.4Nm (30 in.lbs.) max.

Label	Meaning
	WARNING! Read and understand the supplied Operator's Manual before operating this machine. Failure to do so increases the risk of injury to yourself or others.
	Blade pitch control. Turn both controls inward to increase blade pitch. Refer to section *Pitch Adjustment.*
	Operator's Manual must be stored on machine. Replacement Operator's Manual can be ordered through your local Wacker distributor.
	WARNING! Remove pan from trowel before lifting machine overhead. Pans can fall and cause death or serious injury if a person is hit. (Located on top side of float pan.)
	WARNING! Pinching hazard. Rotating machinery.

Label	Meaning
	Refer to *Status Indicator Lights* section for explanation of this label.
	CAUTION! Disconnect battery before removing cover. Replace cover before using the machine.
	CAUTION! Engine oil pressure is low! Stop the engine and check the oil level. CAUTION! Low voltage! Stop the engine and check the charging system. CAUTION! Coolant Temperature is too high. Stop the engine and check the coolant level.
	A nameplate listing the model number, item number, revision number, and serial number is attached to each unit. Please record the information found on this plate so it will be available should the nameplate become lost or damaged. When ordering parts or requesting service information, you will always be asked to specify the model number, item number, revision number, and serial number of the unit.
	This machine may be covered by one or more patents.
	DANGER! Engines emit carbon monoxide; operate only in well-ventilated area. Read the operator's manual for machine information.

Label	Meaning
	WARNING! Always wear hearing and eye protection when operating this machine. Read the operator's manual for machine information.
	WARNING! Read and understand the supplied Operator's Manual before operating this machine. Failure to do so increases the risk of injury to yourself or others.
	Steering control. Refer to section *Steering.*
	CAUTION! Engine oil pressure is low! Stop the engine and check the oil level.
	CAUTION! Low voltage! Stop the engine and check the charging system.
	CAUTION! Coolant Temperature is too high. Stop the engine and check the coolant level.

2. Technical Data

2.1 Engine—CRT 36

Part No.		CRT 36A 0009232	CRT 36A-E 0009483
Engine			
Engine Make		Honda	
Engine Model		GX670	
Rated Power	kW (Hp)	17.9 (24)	
Displacement	cm^3 (in^3)	670 (41)	
Spark Plug		NGK ZGR5A DENSO J16CR-U	
Electrode Gap	mm (in.)	0.70 (0.028)	
Engine Speed - full load	rpm	3850	
Engine Speed - idle	rpm	1400	
Battery	V / size	12 / 340CCA	
Fuel	type	Regular unleaded gasoline	
Fuel Tank Capacity	l (gal.)	24.6 (6.5)	
Fuel Consumption	l (qt.)/hr.	9 (9.5)	
Running Time	hrs.	2.7	
Clutch	type	variable speed	
Low Oil Shutdown		yes	
Engine Oil Capacity	l (qt.)	1.9 (2.0)	
Engine Lubrication	oil grade	SAE 10W30 API CF-4, CF, SJ	

2.2 Trowel—CRT 36

Part No.		CRT 36A 0009232 Rev. 144 and lower	CRT 36A 0009232 Rev. 145 and higher	CRT 36A-E 0009483 Rev. 117 and lower	CRT 36A-E 0009483 Rev. 118 and higher
Trowel					
Operating Weight	kg (lbs.)	410 (905)			
Dimensions (L x W x H)	mm (in.)	2170 x 1170 x 1330 (86 x 46 x 52)		2032 x 1170 x 1320 (80 x 46 x 52)	
Rotor Speed (range)	rpm	35-150			
Blade Pitch (range)	degrees	0-25			
Gearbox	type	heavy duty			
Gearbox Lubrication	type	Mobil Oil SHC634	Mobil Glygoyle 460	Mobil Oil SHC634	Mobil Glygoyle 460
	l (oz.)	1.83 (62) each			
Driveshaft	type	splined universal joint			

Operation			
Troweling Width **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	mm (in.)	1975 (78) 2020 (80) --	1975 (78) -- 1905 (75)
Troweling Area **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	m^2 (ft^2)	1.8 (19) 2.0 (22) --	1.8 (19) -- 1.6 (18)

2.3 Sound and Vibration Specifications—CRT 36

The required sound specifications, per Appendix 1, Paragraph 1.7.4.f of the EC-Machine Regulations, are:

-the sound pressure level at operator's location (L_{pA}): 84 dB(A)

-the guaranteed sound power level (L_{WA}): 102 dB(A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 11204 for the sound pressure level (L_{pA}) at the operator's location.

The weighted effective acceleration value, determined according to ISO 2361-1 and ISO 5349, is:

-for whole body: 0,05 m/s2

-for hand/arm: 3,15 m/s2

The sound and vibration specifications were obtained with the unit operating on fully cured, water wetted concrete at nominal engine speed.

2.4 Engine—CRT 48 (manual steer)

Part No.		**CRT 48-31V** 0009086	**CRT 48-31V-E** 0009481
Engine			
Engine Make		Vanguard	
Engine Model		DM950G	
Rated Power	kW (Hp)	23.1 (31)	
Displacement	cm^3 (in^3)	950 (58)	
Spark Plug	type	Champion RC12YC	
Electrode Gap	mm (in.)	0.76 (0.030)	
Engine Speed - full load	rpm	4000	
Engine Speed - idle	rpm	1500	
Battery	V / size	12 / BCI G24	
Fuel	type	Regular unleaded gasoline	
Fuel Tank Capacity	l (gal.)	24.6 (6.5)	
Fuel Consumption	l (gal.)/hr.	10 (2.6)	
Running Time	hrs.	2.5	
Clutch	type	variable speed	
Low Oil Shutdown		yes	
Engine Oil Capacity	l (qt.)	3.3 (3.5)	
Engine Lubrication	oil grade	SAE 10W30 SH, SJ	

2.5 Trowel—CRT 48 (manual steer)

Part No.		CRT 48-31V 0009086 Rev. 145 and lower	CRT 48-31V 0009086 Rev. 146 and higher	CRT 48-31V-E 0009481 Rev. 120 and lower	CRT 48-31V-E 0009481 Rev. 121 and higher
Trowel					
Operating Weight	kg (lbs.)	562 (1240)			
Dimensions (L x W x H)	mm (in.)	2665 x 1395 x 1330 (105 x 55 x 52)		2530 x 1397 x 1328 (100 x 55 x 52)	
Rotor Speed (range)	rpm	25-150			
Blade Pitch (range)	degrees	0-25			
Gearbox	type	heavy duty, fan cooled			
Gearbox Lubrication	type	Mobil Oil SHC634	Mobil Glygoyle 460	Mobil Oil SHC634	Mobil Glygoyle 460
	l (oz.)	1.83 (62) each			
Driveshaft	type	splined universal joint			

Operation			
Troweling Width **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	mm (in.)	2465 (97) 2515 (99) --	2465 (97) -- 2413 (95)
Troweling Area **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	m^2 (ft^2)	3 (32) 3.2 (34) --	3 (32) -- 2.8 (30)

2.6 Sound and Vibration Specifications—CRT 48 (manual steer)

The required sound specification, Paragraph 1.7.4.f of 89/392/EEC Machinery Directive, is:

- the sound pressure level at operator's location (L_{pA}) 91 dB(A)
- the guaranteed sound power level (L_{WA}) 109 dB(A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 11204 for the sound pressure level (L_{pA}) at the operator's location.

The weighted effective acceleration value, determined according to ISO 2361-1 and ISO 5349, is:

- for whole body 1.29 m/s^2
- for hand/arm 2.85 m/s^2

The sound and vibration specifications were obtained with the unit operating on fully cured, water wetted concrete at nominal engine speed.

2.7 Engine—CRT 48 (electric steer)

Part No.		**CRT 48-31V-ES** 0009216	**CRT 48-31V-ES-E** 0009482
Engine			
Engine Make		Vanguard	
Engine Model		DM950G	
Rated Power	kW (Hp)	23.1 (31)	
Displacement	cm^3 (in^3)	950 (58)	
Spark Plug	type	Champion RC12YC	
Electrode Gap	mm (in.)	0.76 (0.030)	
Engine Speed - full load	rpm	4000	
Engine Speed - idle	rpm	1500	
Battery	V / size	12 / Group 24	
Fuel	type	Regular unleaded gasoline	
Fuel Tank Capacity	l (gal.)	24.6 (6.5)	
Fuel Consumption	l (gal.)/hr.	10 (2.6)	
Running Time	hrs.	2.5	
Clutch	type	variable speed	
Low Oil Shutdown		yes	
Engine Oil Capacity	l (qt.)	3.3 (3.5)	
Engine Lubrication	oil grade	SAE 10W30 SH, SJ	
Driveshaft	type	splined universal joint	

2.8 Trowel—CRT 48 (electric steer)

Part No.		**CRT 48-31V -ES** 0009216 Rev. 118 and lower	**CRT 48-31V -ES** 0009216 Rev. 119 and higher	**CRT 48-31V -ES-E** 0009482 Rev. 118 and lower	**CRT 48-31V -ES-E** 0009482 Rev. 119 and higher
Trowel					
Operating Weight	kg (lbs.)	528 (1165)			
Dimensions (L x W x H)	mm (in.)	2665 x 1395 x 1330 (105 x 55 x 52)		2530 x 1397 x 1328 (100 x 55 x 52)	
Rotor Speed (range)	rpm	25-150			
Blade Pitch (range)	degrees	0-25			
Gearbox	type	heavy duty, fan cooled			
Gearbox Lubrication	type	Mobil Oil SHC634	Mobil Glygoyle 460	Mobil Oil SHC634	Mobil Glygoyle 460
	l (oz.)	1.83 (62) each			

Operation			
Troweling Width **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	mm (in.)	2465 (97) 2515 (99) --	2465 (97) -- 2413 (95)
Troweling Area **with pans** (non-overlapping) **without pans** (overlapping) **without pans** (non-overlapping)	m^2 (ft^2)	3 (32) 3.2 (34) --	3 (32) -- 2.8 (30)

2.9 Sound and Vibration Specifications—CRT 48 (electric steer)

The required sound specification, Paragraph 1.7.4.f of 89/392/EEC Machinery Directive, is:

- the sound pressure level at operator's location (L_{pA}) 91 dB(A)
- the guaranteed sound power level (L_{WA}) 109 dB(A)

These sound values were determined according to ISO 3744 for the sound power level (L_{WA}) and ISO 11204 for the sound pressure level (L_{pA}) at the operator's location.

The weighted effective acceleration value, determined according to ISO 2361-1 and ISO 5349, is:

- for whole body 1.29 m/s^2
- for hand/arm 2.85 m/s^2

The sound and vibration specifications were obtained with the unit operating on fully cured, water wetted concrete at nominal engine speed.

3. Operation

3.1 Description

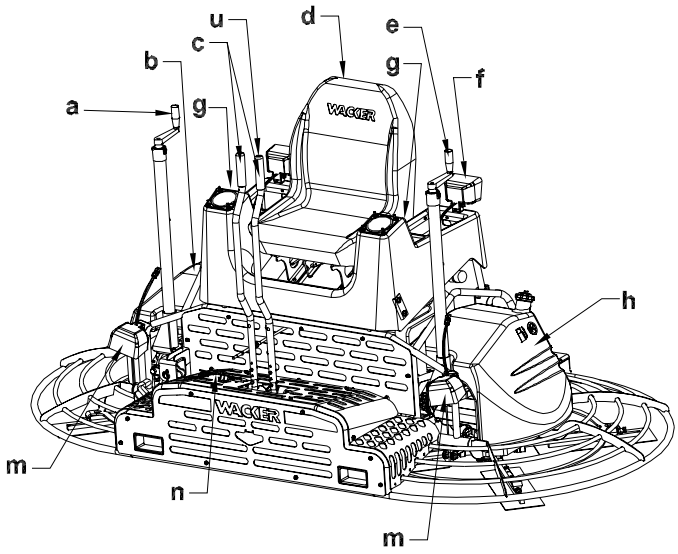
The Wacker CRT Model Riding Trowels are modern, high production machines intended for finishing concrete. Finishing rates vary depending on operator skill and job conditions. Available in two models, Wacker CRT Riding Trowels are equipped with heavy-duty gearboxes designed to provide exceptional performance, low maintenance, and trouble-free use in most conditions. Each model also includes an operator presence system and an engine with low-oil shutdown protection.

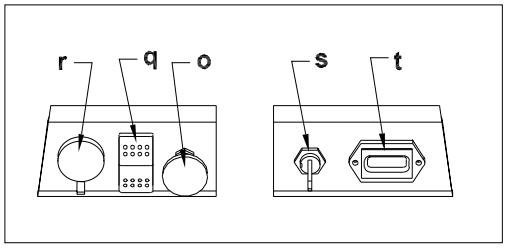
Wacker CRT Riding Trowels are the most technically advanced trowels on the market today. With proper maintenance and use, your Riding Trowel will provide you with years of service.

3.2 Information Regarding Operation

The information regarding the operation of the machine included in this manual is condensed. Refer to the Operator's Manual for complete operating instructions. Always read, understand, and follow the procedures in the Operator's Manual when operating the machine.

3.3 Features and Controls—CRT 36/48 Manual Steer

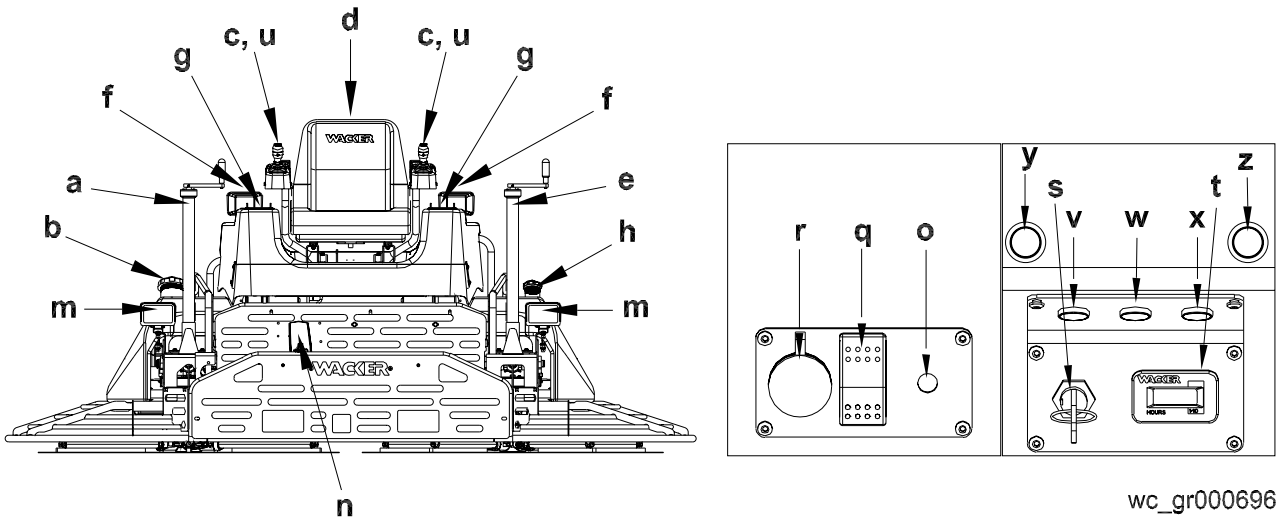




wc_gr000142

a	Right pitch control	**m**	Work light (one each side)
b	Water tank	**n**	Foot pedal (throttle control)
c	Control arms	**o**	Engine choke control
d	Operator's seat with "operator presence" switch	**q**	Work light switch
e	Left pitch control	**r**	DC accessory outlet
f	Rear work light (one each side)	**s**	Engine keyswitch
g	Control panel (one each side)	**t**	Hour meter
h	Fuel tank	**u**	Water spray control

3.4 Features and Controls—CRT 48 Electric Steer



Ref.	Description	Ref.	Description
a	Right pitch control	**q**	Work light switch
b	Water tank	**r**	DC accessory outlet
c	Joystick	**s**	Engine keyswitch
d	Operator's seat with "operator presence" switch	**t**	Hour meter
e	Left pitch control	**u**	Water spray control
f	Rear work light (one each side)	**v**	Oil pressure indicator light
g	Control panel	**w**	Alternator charging indicator light
h	Fuel tank	**x**	Coolant temperature indicator light
m	Work light (one each side)	**y**	Status OK indicator light (green)
n	Foot pedal (throttle control)	**z**	Status error indicator light (red)
o	Engine choke control		

3.5 Before Starting

Before starting the trowel, check the following:

- fuel level
- oil level in the engine
- condition of the air filter
- condition of trowel arms and blades

Grease the trowel arms daily.

3.6 Starting

Before starting the operator must know the location and function of all controls.

3.6.1 Push down on the throttle foot pedal, turn the engine keyswitch **(s),** and hold it until the engine starts.

Note: *If the engine is cold, pull out the choke control knob fully.*

CAUTION: Cranking the engine for more than 5 seconds can cause starter damage. If the engine fails to start, release the keyswitch and wait 10 seconds before operating the starter again.

Note: *The engine has an oil alert switch designed to stop the engine automatically if the oil level gets too low. If engine will not start, or stops during operation, check engine oil level.*

3.6.2 Allow the engine to warm up before operating the trowel.

3.7 Stopping

To stop trowel movement, return joystick(s) or control levers to their neutral position and release pressure on the throttle foot pedal.

To stop the engine, turn the keyswitch to “O” (off).

4. Maintenance

4.1 Periodic Maintenance Schedule—CRT 36

The chart below lists basic trowel and engine maintenance. Refer to engine manufacturer's Operator's Manual for additional information on engine maintenance. A copy of the engine Operator's Manual was supplied with the machine when it was shipped. To service the engine, tilt the seat forward.

	Daily	Every 20 hrs.	Every 50 hrs.	Every 100 hrs.	Every 200 hrs.	Every 300 hrs.
Grease trowel arms.	•					
Check fuel level.	•					
Check engine oil level.[1]	•					
Inspect air filter. Replace as needed.	•					
Check and tighten external hardware.	•					
Pressure wash all surfaces until free of concrete.[2]	•					
Check oil level in gearboxes.		•				
Grease gearbox, drive system and pitch posts fittings.		•				
Grease control linkage.[3]		•				
Check drive belt for wear.			•			
Change engine oil.[4]				•		
Check fuel filter.				•		
Clean and check spark plug.					•	
Replace oil filter.					•	
Replace spark plug.						•
Replace fuel filter.						•
Replace gearbox pressure relief valve.						•
Replace oil in gearboxes.						•

[1] Check engine oil twice daily (every 4 hours).

[2] Pressure wash immediately after use.

[3] Manual steering models only.

[4] Change engine oil after first 20 hours of operation.

4.2 Periodic Maintenance Schedule—CRT 48

The chart below lists basic trowel and engine maintenance. Refer to engine manufacturer's Operator's Manual for additional information on engine maintenance. A copy of the engine Operator's Manual was supplied with the machine when it was shipped. To service the engine, tilt the seat forward.

	Daily	Every 20 hrs.	Every 50 hrs.	Every 100 hrs.	Every 200 hrs.	Every 300 hrs.
Grease trowel arms.	•					
Check fuel level.	•					
Check engine oil level.[1]	•					
Inspect air filter. Replace as needed.	•					
Check and tighten external hardware.	•					
Pressure wash all surfaces until free of concrete.[2]	•					
Check coolant level.	•					
Check oil level in gearboxes.		•				
Grease gearbox input shaft fitting		•				
Grease control linkage.[3]		•				
Check drive belt for wear.			•			
Change engine oil.[4]				•		
Check fuel filter.				•		
Clean and check spark plug.					•	
Replace oil filter.					•	
Check fan belt.					•	
Replace spark plug.						•
Replace fuel filter.						•
Replace gearbox pressure relief valve.						•
Replace oil in gearboxes.						•
Change coolant.						•

[1] Check engine oil twice daily (every 4 hours).
[2] Pressure wash immediately after use.
[3] Manual steering models only.
[4] Change engine oil after first 20 hours of operation.

4.3 Trowel Gearboxes

See Graphic: wc_gr000156

Check the gearboxes for the correct oil level after every 20 hours of operation. Change the gearbox oil every 300 hours.

To check the oil level:

Each CRT gearbox is equipped with two oil fill plugs. Remove one gearbox oil fill plug **(b)**. If the level is below the threads of the oil fill plug hole, add synthetic gear oil through the opening. DO NOT overfill. Wipe the threads dry on both the gearbox and the oil fill plug, apply Loctite 545 or equivalent to the oil fill plug threads, replace the oil fill plug and torque to 16–20 Nm (12–15 ft.lbs.).

CAUTION: DO NOT mix types of gear oil. **DO NOT** overfill the gearbox with oil. Damage to the gearbox may occur if oils are mixed, or if the gearbox is overfilled. See *Technical Data* for oil quantity and type.

To change gearbox oil:

4.3.1 Place a container of sufficient capacity (approximately 3.8 l [1 gallon]) under each gearbox.

4.3.2 Remove the gearbox oil drain plug **(c)** and allow the oil to drain out. It may be necessary to remove the gearbox oil fill plug(s) to facilitate draining. After most of the oil has drained out, tip the back of the trowel upwards to allow the remaining oil to drain out.

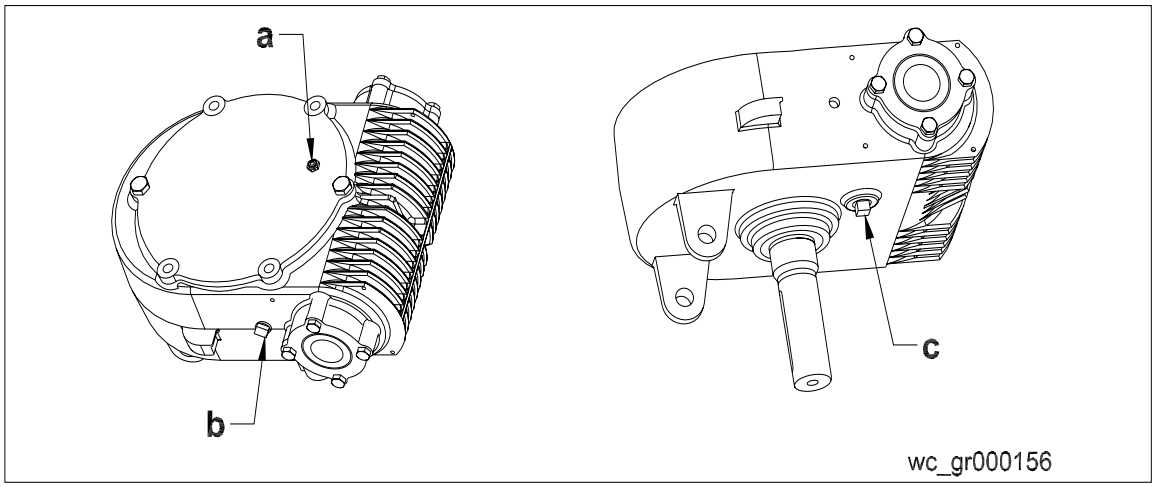
4.3.3 After all the oil has drained out, wipe the threads dry on both the gearbox and the oil drain plug, apply Loctite 545 or equivalent to the oil drain plug threads, and replace the gearbox oil drain plug.

Note: *Dispose of used gear oil in accordance with environmental protection legislation.*

4.3.4 With the trowel level, fill the gearbox with approximately 1.83 l (62 oz.) synthetic gear oil through the oil fill plug as described above.

4.3.5 Wipe the threads dry on both the gearbox and the oil fill plug, apply Loctite 545 or equivalent to the oil fill plug threads, replace the oil fill plug(s), and torque all plugs to 16-20Nm (12–15 ft.lbs.).

Each gearbox has a pressure relief valve **(a)** which can become clogged over time and should be replaced every 300 hours. Failure to replace the valve can result in oil leakage from the gearbox shaft seals.

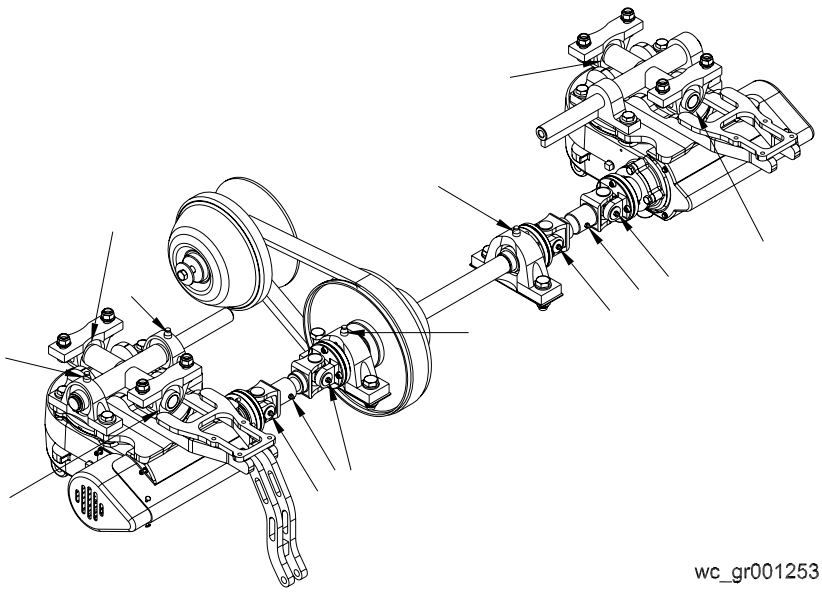


4.4 Lubrication

See Graphic: wc_gr001253

The drive system, gearbox and pitch posts are equipped with several grease fittings. Grease these fittings once a week, or every 20 hours, to prevent wear.

Use a general purpose grease and add one to two shots of grease at each fitting.



4.5 Switching Blade Positions

See Graphic: wc_gr000255

To switch the position of the blades from the non-overlapping position **(f)** to the overlapping position **(g)**:

4.5.1 Place the trowel on a flat, level surface.

4.5.2 Remove the screws **(a)** holding the blade to the trowel arm.

4.5.3 CRT 48 only - Remove the plastic plug from the off-set screw hole **(b)** and place it into screw hole **(c)** to prevent it from filling with concrete.

4.5.4 Raise the trowel very slightly to take the weight off of the blades. Use a fork lift or dolly jacks.

4.5.5 Slide the blades to align them with the screw holes **(d)**.

CAUTION

Trowel blades may be sharp! Use adequate protection to keep from cutting skin or clothing!

4.5.6 Lower the trowel so the arms are securely against the blades.

4.5.7 Secure the screws into the screw holes **(d)**. Dip the threads of the screws in grease prior to installation. This will prevent concrete from cementing the screws in place and make removal of the blades easier later on.

Note: *Do not operate the trowel unless all blades are either in the overlapping or non-overlapping position.*

To switch the position of the blades from overlapping to non-overlapping, reverse the process.

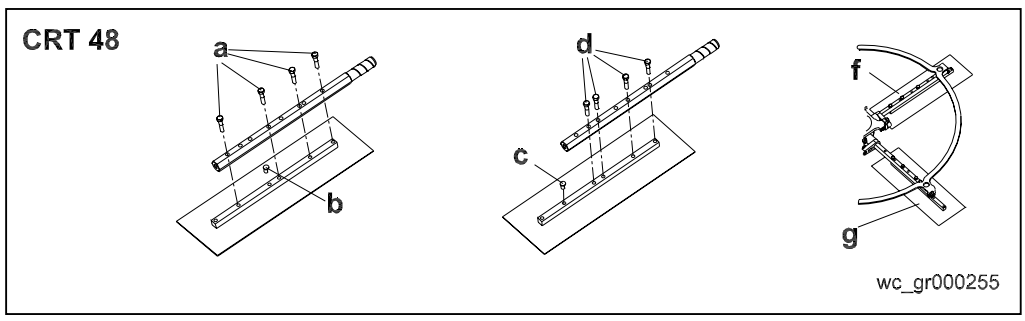
Blade Arm Adjustment Procedure

To eliminate wobble:

4.5.1 Pitch the blades flat.

4.5.2 Tighten lock nut located at the bottom of each pitch cable. Maximum cable play should be no more than 3.18 mm (.125”) or the width of the cable.

4.5.3 Set gap on all adjustable links to 4.58 mm (.180”).



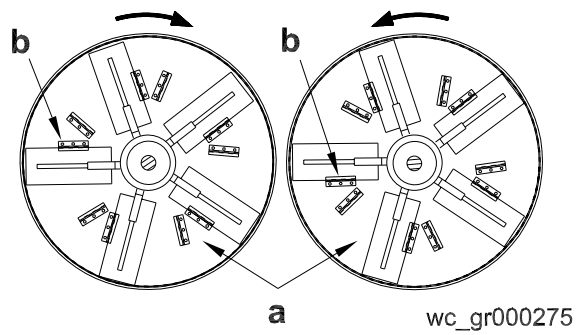
4.6 Mounting Float Pans

See Graphic: wc_gr000275 and wc_gr000151

Certain applications may require the use of float pans. Optional float pans **(a)** are available, and are used with the machines in the non-overlapping configuration only.

To mount float pans:

Lift trowel off the ground **with the engine off** and position the pan against the blades. Turn pan either to the right or left to engage clip angles **(b)** as shown. Remember, the right-hand trowel blades turn counterclockwise; the left-hand blades turn clockwise.



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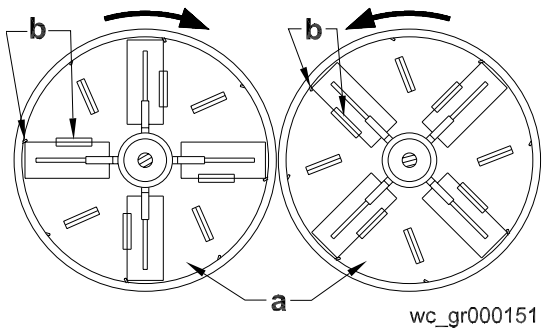

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4.7 Transporting Trowels

See Graphic: wc_gr000697

To lift the trowel with a fork lift:

Fork lift pockets **(a)** are provided on both the front and back of the machine. Carefully run the fork lift's forks into either set of fork lift pockets.

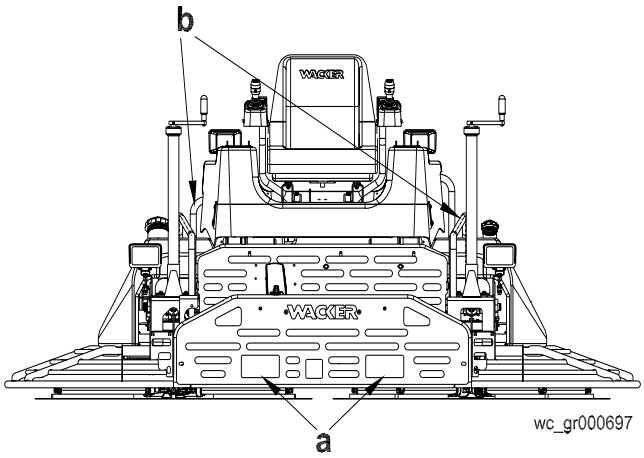
To hoist the trowel:

Attach a sling or chains through the lifting bars **(b)** on each side of the seat pedestal.

CAUTION: Make sure the lifting device has enough weight-bearing capacity to lift machine safely. Refer to Section *Technical Data.*

WARNING

DO NOT lift the trowel by the guard rings or any part of the trowel other than the lifting fixture, as the component may fail, causing the trowel to fall, possibly injuring bystanders.



4.8 Spark Plug—CRT 36

Clean or replace spark plug as needed to ensure proper operation. Refer to the engine Owner's Manual.

Recommended Plug: Champion RC12YC

WARNING The muffler and engine cylinder become very hot during operation and remain hot for a while after stopping the engine. Allow engine to cool before removing spark plug.

4.8.1 Remove spark plug and inspect it.

4.8.2 Replace plug if the insulator is cracked or chipped. Clean spark plug electrodes with a wire brush.

4.8.3 Set gap to 0.76 mm (0.030 in).

4.8.4 Tighten spark plug securely.

CAUTION: A loose spark plug can become very hot and may cause engine damage.

4.9 Spark Plug—CRT 48

Clean or replace spark plug as needed to ensure proper operation. Refer to the engine Owner's Manual.

Recommended Plug: NGK ZGR5A, DENSO J16CR-U

WARNING The muffler and engine cylinder become very hot during operation and remain hot for a while after stopping the engine. Allow engine to cool before removing spark plug.

4.9.1 Remove spark plug and inspect it.

4.9.2 Replace plug if the insulator is cracked or chipped. Clean spark plug electrodes with a wire brush.

4.9.3 Set gap to 0.70 mm (0.028 in).

4.9.4 Tighten spark plug securely.

CAUTION: A loose spark plug can become very hot and may cause engine damage.

4.10 Air Cleaner—CRT 36

See Graphic: wc_gr000154

The engine is equipped with a dual element air cleaner. Service air cleaner frequently to prevent carburetor malfunction.

CAUTION: NEVER run engine without air cleaner. Severe engine damage will occur.

WARNING

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire or explosion could result.

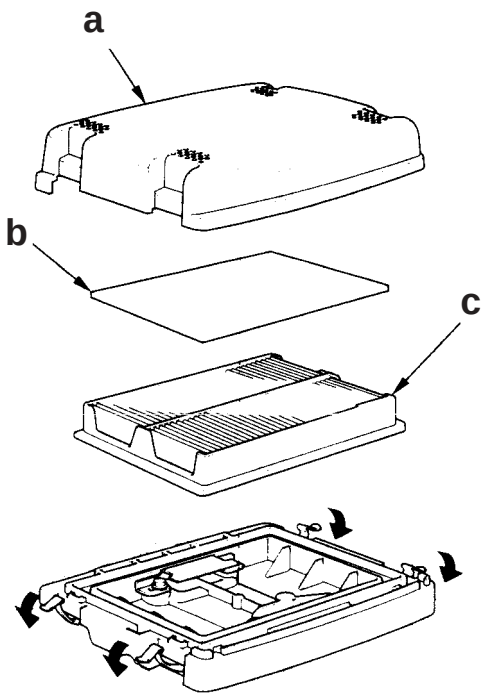
To service:

4.10.1 Remove air cleaner cover **(a)**. Remove both elements **(b, c)** and inspect them for holes or tears. Replace damaged elements.

4.10.2 Wash foam element **(b)** in solution of mild detergent and warm water. Rinse thoroughly in clean water. Allow element to dry thoroughly.

Do not put oil on the foam element.

4.10.3 Tap paper element **(c)** lightly to remove excess dirt. Replace paper element if it appears heavily soiled.



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4.11 Air Cleaner—CRT 48

See Graphic: wc_gr000216

To service:

4.11.1 Unlock clamps **(d)** and remove cover **(c)**.

4.11.2 Remove cartridge **(b)** from air cleaner body **(a)**.

Clean by gently tapping cartridge. (Replace cartridge if very dirty or damaged.)

4.11.3 Carefully clean out air cleaner cover **(c)**.

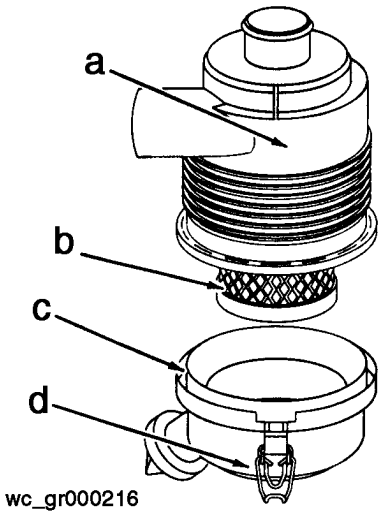
WARNING

NEVER use gasoline or other types of low flash point solvents for cleaning the air cleaner. A fire of explosion could result.

4.11.4 Install cartridge in body

4.11.5 Install cover and lock clamps.

CAUTION: NEVER run engine without air cleaner. Severe engine damage will occur.



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4.12 Engine Oil—CRT 36

See Graphic: wc_gr000155

Drain oil while engine is still warm.

4.12.1 Remove oil fill cap **(a)** and drain plug **(b)** to drain oil.

Note: *In the interests of environmental protection, place a plastic sheet and a container under the machine to collect any liquid which drains off. Dispose of this liquid in accordance with environmental protection legislation.*

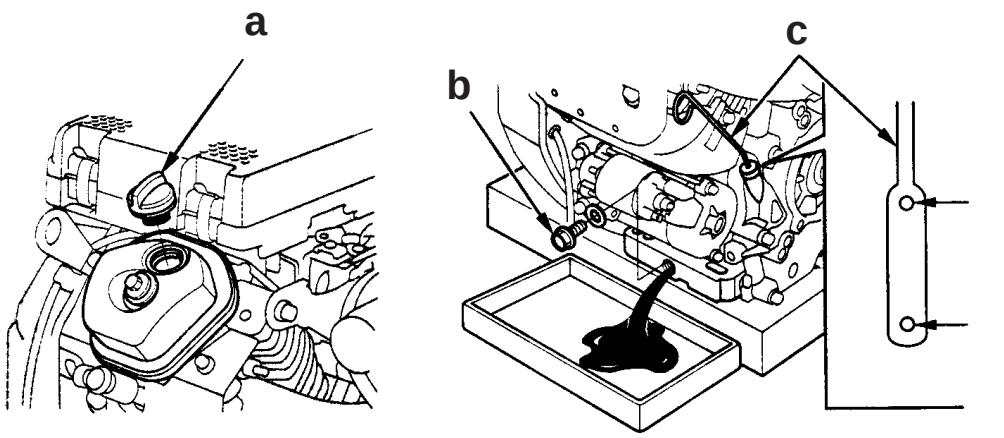
4.12.2 Install drain plug and tighten.

4.12.3 Fill engine crankcase with recommended oil to the upper limit mark on the dipstick **(c)**.

Oil capacity: 1.18 l (1.25 qt.).

4.12.4 Install oil fill cap and dipstick securely.

4.12.5 To replace the oil filter, remove the installed oil filter after oil has been drained. Apply a thin coat of oil to the rubber gasket of the replacement oil filter. Screw the filter on until it just contacts the filter adapter, then turn it an additional 22.24mm (7/8in) turn. Refill with oil as described above.



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4.13 Engine Oil—CRT 48

See Graphic: wc_gr000217

Drain oil while engine is still warm.

4.13.1 Remove oil fill cap **(a)** and drain plug **(b)** to drain oil.

Note: *In the interests of environmental protection, place a plastic sheet and a container under the machine to collect any liquid which drains off. Dispose of this liquid in accordance with environmental protection legislation.*

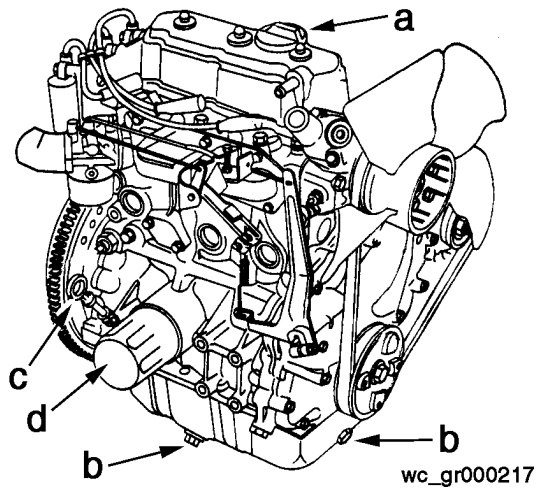
4.13.2 Install drain plug and torque to 34.6 Nm (25.5 ft.lbs.).

4.13.3 Fill engine crankcase with recommended oil until the level is between “L” and “F” on the dipstick **(c)**.

Oil capacity: 3 l (3.2 qt.).

4.13.4 Install oil fill cap.

4.13.5 To replace the oil filter **(d)**, remove the installed oil filter after oil has been drained. Apply a thin coat of oil to the rubber gasket of the replacement oil filter. Screw the filter on until it just contacts the filter adapter, then turn it an additional ½ turn. Refill with oil as described above.



4.14 Basic Troubleshooting

Problem	Reason	Remedy
Engine does not start.	Operator present switch is not engaged.	Sit in operator's seat.
	Oil alert shutdown feature is activated.	Add oil to engine.
	Engine problem.	Oil alert shutdown feature is activated.
Machine out of balance; wobbling excessively.	Operator is over-steering.	The movement of each gearbox is controlled by “stops” to provide the correct relationship of the control arm movement to machine movement. Excessive pressure on control arms in any direction will not increase reaction time and can damage steering controls causing machine to wobble.
	Trowel arm(s) bent.	Replace trowel arm(s).
	Trowel blade(s) bent.	Replace trowel blade(s).
	Main shaft(s) bent due to machine being dropped.	Replace main shafts(s).
Machine does not move.	Drive belt broken.	Replace drive belt.
	Vacuum between bottom of blades and surface of concrete.	Change pitch on blades to break suction.
	Key sheared in the main shaft.	Replace damaged key.

Problem	Reason	Remedy
Machine does not respond correctly to control lever movement.	Sheared key.	Check all keys in drive system.
	Loose electrical connector on actuator or joystick.	Check all connections.
	Electronic control board failure.	Replace electronic control board.
Trowel noisy.	Trowel blades have become misaligned and are contacting each other during rotation.	Replace damaged blades. Align blades so that one set represents a (+) and the other an (x) when viewed from above.
	Sheared key.	Check all keys in drive system.
	Loose clutch.	Tighten clutch.

5. Drive Train

5.1 Belt Replacement

See Graphic: wc_gr003419

5.1.1 Place the trowel on a flat, level surface with the blades pitched flat.

5.1.2 Disconnect the battery.

5.1.3 Remove the beltguard as follows:

For Honda engines:

- Remove the bolts holding the beltguard in place and remove it.

For Vanguard engines:

- Remove the two bolts holding the base of the air cleaner to the beltguard and remove the air cleaner.
- Slide the wiring harness from the two harness guides.
- Remove the bolts securing the beltguard to the engine and remove the beltguard.

5.1.4 Remove the bolts **(d)**, washers **(e)**, and nuts **(f)** securing each bearing flange **(c)** to the machine.

5.1.5 For CRT 48: On the side closest to the clutch pulley, remove the bolts **(b)** and shims (if included) holding the inside portion of the universal joint to the drive shaft flange **(a)**.
For CRT 36: Remove the bolts **(b)** and shims (if included) holding each inner universal joint to the drive shaft flange(s) **(a)**.

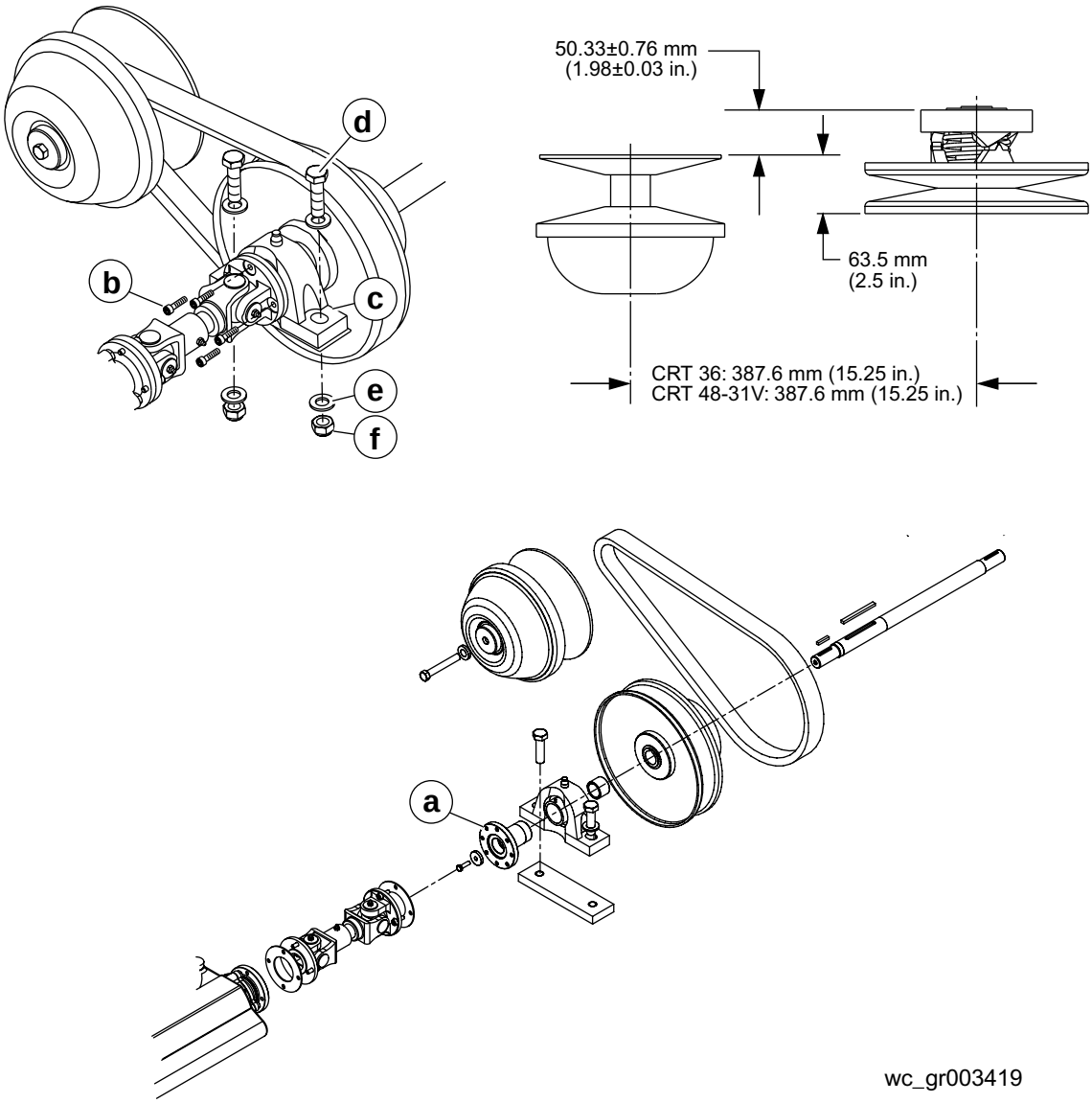
5.1.6 Lift the pulley, the shaft, and the bearing flanges high enough so that the belt can clear the components; once in position, slide the belt off the pulley and remove it from the machine.

5.1.7 Install a new belt in the same manner.

5.1.8 Align the pulley with the clutch so that the offset and center distances match the values shown.

5.1.9 Secure the bearing flanges **(c)** to the machine with bolts **(d)**, washers **(e)**, and nuts **(f)**. Torque the bolts to 134 Nm (99 ft.lbs.).

5.1.10 Secure the universal joints to the shaft flanges **(a)** with bolts **(b)**. Torque the bolts to 13 Nm (10 ft.lbs.).


d
b
c
e
f
50.33±0.76 mm
(1.98±0.03 in.)
63.5 mm
(2.5 in.)
CRT 36: 387.6 mm (15.25 in.)
CRT 48-31V: 387.6 mm (15.25 in.)
a
wc_gr003419

5.2 Drive Line Teardown and Rebuild

See Graphic: wc_gr001580

Disassembly:

5.2.1 Remove the drive belt. Also remove the drive shaft, pulley, and bearing flanges as an assembly. See section *Belt Replacement.*

5.2.2 Remove the screws **(a)** from the outside end of both universal joints **(c)** and remove the universal joints from the gearboxes.

5.2.3 Remove the center bolt **(i)** and washer **(k)** from both of the shaft flanges **(l)**. Using a puller, remove the bearing flanges **(g)** (including the shaft flanges) from the drive shaft. Also remove the keys **(j)**.

5.2.4 Remove the setscrews from the bearing flanges.

5.2.5 Using a press, press the shaft flanges **(l)** from the bearing flanges **(g)**.

5.2.6 Slide the small spacer **(p)**, the pulley **(n)**, and the large spacer **(o)** off the drive shaft. Remove the key **(m)**.

Assembly:

5.2.7 Apply anti-seize compound to the mounting areas of the drive shaft **(p)**.

5.2.8 Install the key **(m)**, and slide the spacer **(o)** and the pulley **(n)** onto the drive shaft.

5.2.9 Press the shaft flanges **(l)** into the bearing flanges **(g)** and tighten the setscrews.

5.2.10 Install the keys **(j)** onto the drive shaft. Install the bearing flange/shaft flange assemblies. Apply Loctite 243 to the center bolts **(i)** and reinstall them and the washers **(k)**. Torque the center bolts to 10 Nm (7 ft.lbs.).

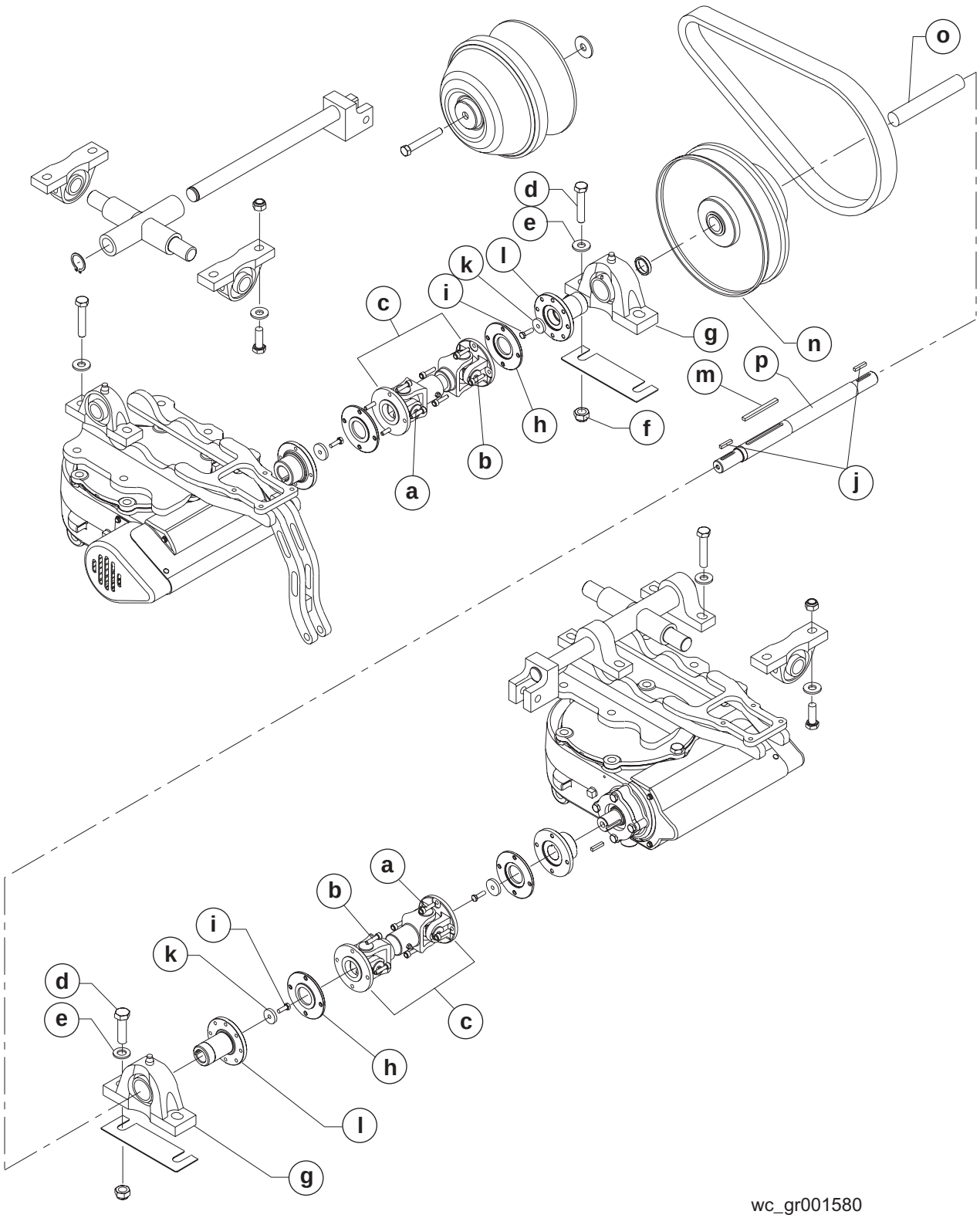
5.2.11 Attach the inside ends of the universal joints and the shims **(h)** to the shaft flanges with screws **(b)**. Torque the screws to 10 Nm (7 ft.lbs.).

5.2.12 Position the drive belt around the pulley.

5.2.13 Place the assembled drive shaft into the machine.

5.2.14 Apply Loctite 243 or an equivalent to the bolts **(d)** and reinstall each bearing flange **(g)** with the bolts, washers **(e)**, and nuts **(f)**. Torque the bolts to 135 Nm (99 ft.lbs.).

5.2.15 Apply Loctite 243 to the screws **(a)** and attach the outside end of each universal joint **(c)** to the gearboxes. Torque the screws to 10 Nm (7 ft.lbs.).



wc_gr001580

6. Spiders and Gearboxes

6.1 Gearbox Basics

See Graphic: wc_gr001579

Rotation of the gearboxes differs depending on which side of the trowel the gearbox is located. When viewed from the operator's position, gearboxes located on the right-hand side of the trowel rotate counterclockwise; gearboxes on the left-hand side of the trowel rotate clockwise.

The rotors ("spiders"), which hold the blades, require proper timing so they will not interfere with each other during operation.

Anytime the drive line is worked on or gearboxes are removed, timing of the spiders should be checked.

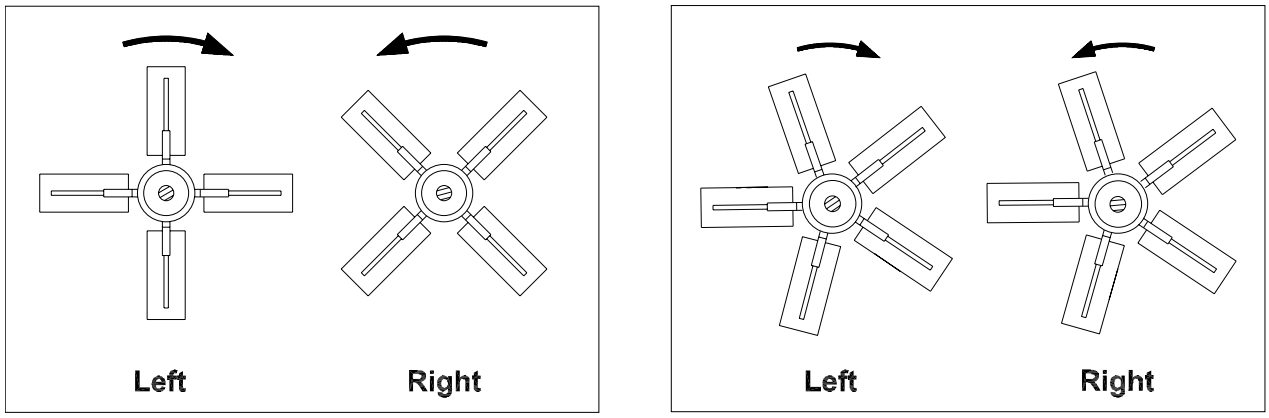
To time the spiders:

6.1.1 Elevate the trowel off the ground. Use either the dolly jack wheels or place the trowel on blocks.

6.1.2 Disconnect one of the universal joints from one of the gearboxes.

6.1.3 Rotate the input shaft of the disconnected gearbox until the blades align as shown.

6.1.4 Reconnect the universal joint.



wc_gr001579

6.2 Gearbox Removal and Installation

See Graphic: wc_gr003420 and wc_gr003421

This procedure requires a lift or crane capable of lifting the trowel 562 kgs. (1240 lbs.).

6.2.1 Position the trowel on a flat, level surface large enough for the trowel and capable of supporting the weight of the trowel.

6.2.2 Pitch the blades so they lie flat.

6.2.3 Disconnect the battery.

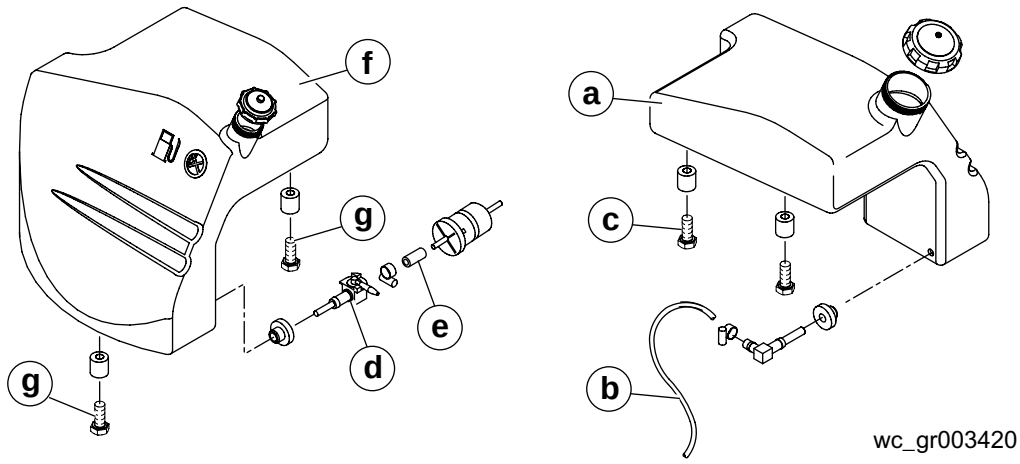
Removal:

6.2.4 Preliminary steps for the right-side gearbox:

- Drain the water tank **(a)**.
- Loosen the clamp that secures the water line **(b)** to the water tank and remove the water line from the water tank.
- Remove the two bolts **(c)** located underneath the water tank and lift the water tank from the frame.

6.2.5 Preliminary steps for the left-side gearbox:

- Close the fuel valve **(d)**. Loosen the clamp and remove the fuel hose **(e)** from the fuel tank **(f)**. Catch any fuel that may drip from the fuel hose with an appropriate container.
- Remove the bolts **(g)** (and spacers if equipped) located underneath the fuel tank and lift the fuel tank from the frame.



wc_gr003420

6.2.6 Remove the nut from each pitch cable **(h)** and pull the cable out of the pitch yoke.

6.2.7 Remove the screws that secure the pitch control assembly **(i)** and remove the pitch control assembly.

6.2.8 Disconnect the wiring **(j)** to the work lights.

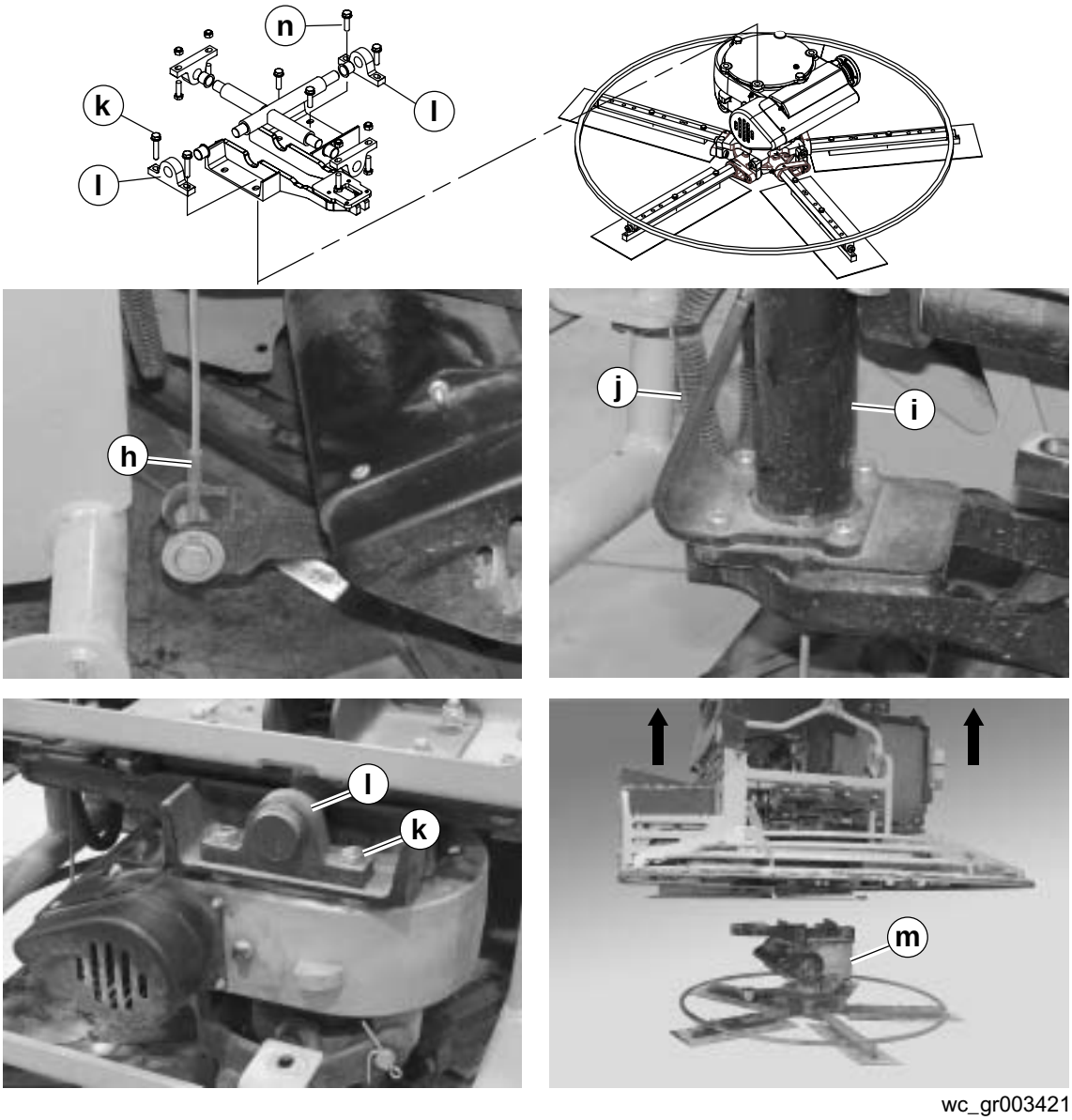
6.2.9 Remove the bolts **(k)** and washers securing the bearing flanges **(l)** on each gearbox.

6.2.10 Using an appropriate lifting crane or hoist, carefully and slowly lift the trowel off the gearbox(es) **(m)**.

WARNING

During lifting, the trowel will be unbalanced and could swing. Be sure to have an additional person to guide the trowel.

6.2.11 Remove the spiders from the gearboxes. See section *Spider Removal and Installation*.



wc_gr003421

Installation:

6.2.12 Install the spiders to the gearboxes. See section *Spider Removal and Installation*.

6.2.13 Position the gearboxes underneath the trowel.

6.2.14 Align the bolt holes with the bearing flanges **(l)**. Secure the bearing flanges to the gearboxes with bolts **(k)** and washers. Torque the bolts to 86 Nm (63 ft.lbs.).

6.2.15 Secure the pitch control assemblies **(i**) to the machine.

6.2.16 Secure the pitch control cables **(h)** to the yokes.

6.2.17 Connect the work light harness.

6.2.18 For the right-side gearbox:

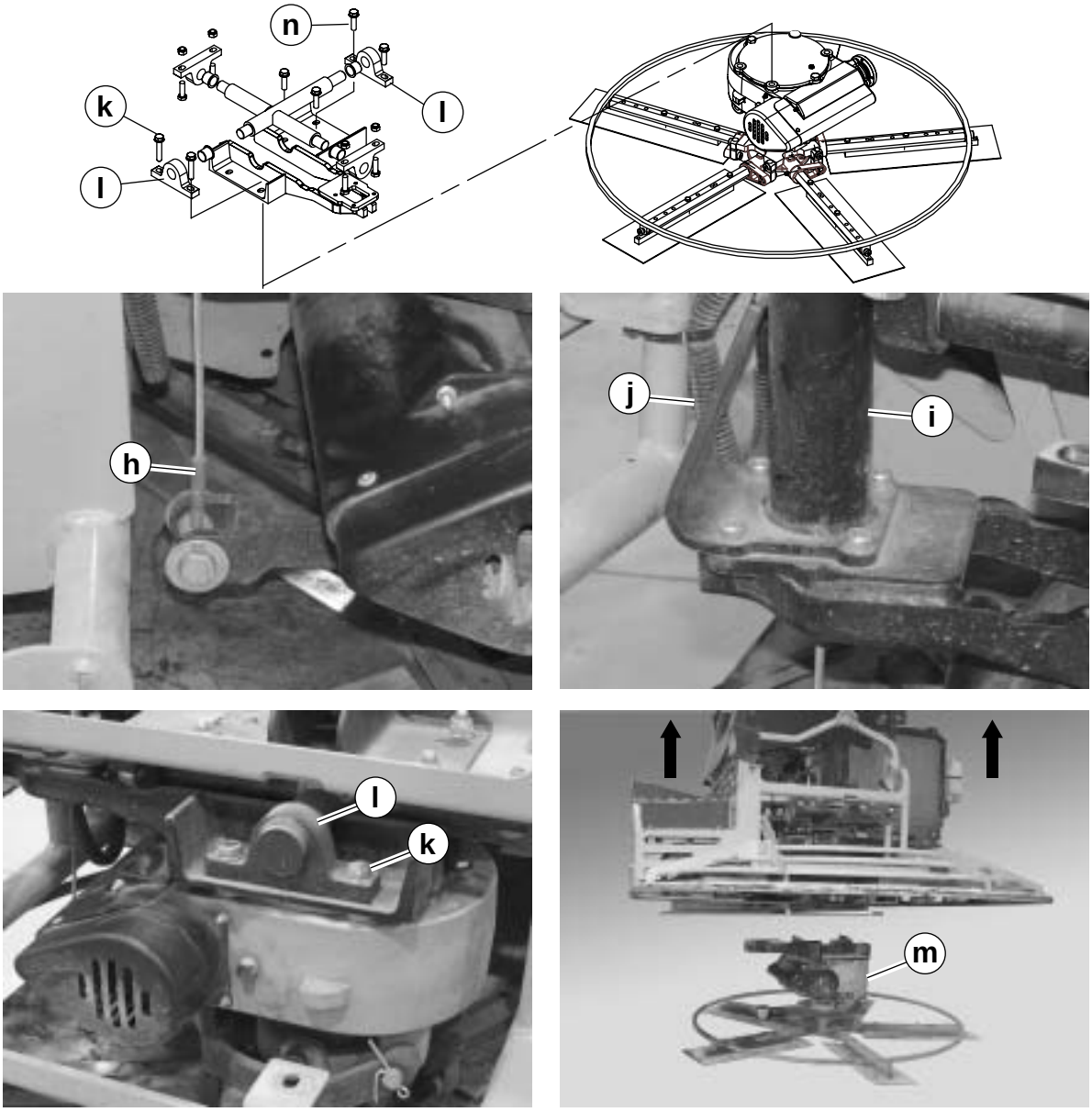
- Position the water tank onto the frame and secure it with bolts from underneath.
- Attach the water line to the water tank and tighten the clamp.

6.2.19 For the left-side gearbox:

- Position the fuel tank on the frame and secure it with bolts from underneath.
- Slide the fuel hose onto the fitting and tighten the clamp.

6.2.20 Secure the drive train to the gearbox. *See Drive Line Teardown and Rebuild.*

6.2.21 Align the blades. See section *Gearbox Basics.*



wc_gr003421

6.3 Spider Removal and Installation

See Graphic: wc_gr003422

Removal:

6.3.1 Remove the gearbox(es) from the machine. See section *Gearbox Removal and Installation.*

6.3.2 Remove the screws that secure the blades to the arms and remove the blades

CAUTION

The blades may have sharp edges that can cut. Wear an appropriate pair of gloves when removing the blades.

6.3.3 On machines with stabilizer rings, remove the shoulder bolts from the ends of the arms and remove the stabilizer rings **(a)**.

6.3.4 Remove the shoulder bolts **(b)** from the lift ring assembly. Do not change the position (rotate) of the lifting links **(c)** unless readjustment is being done.

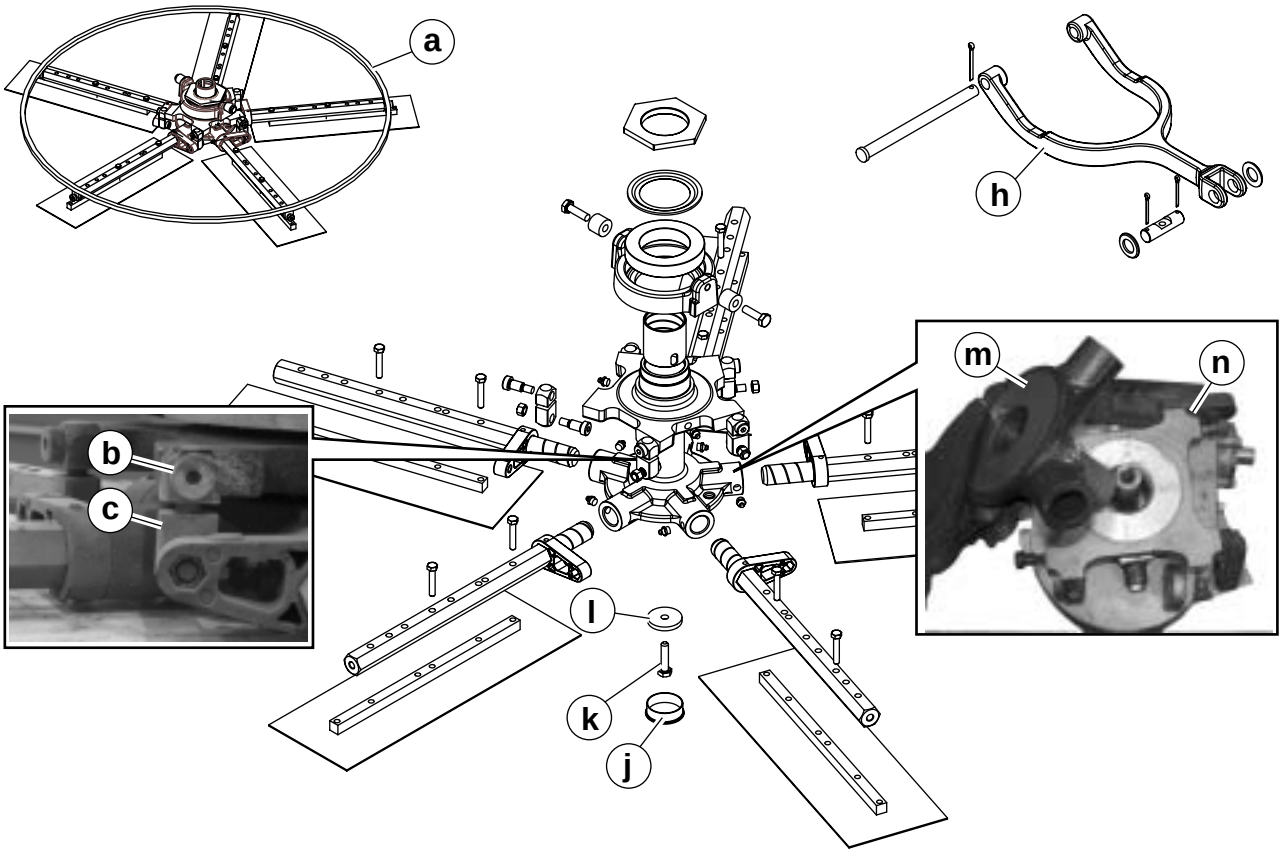
6.3.5 There are two styles of arms used. One style uses a locking pin to retain the arm to the spider. This style is characterized by the hex nut **(d)** into which the grease fitting is installed. If your trowel has this style arm, remove the locking pin (with the grease fitting). On styles with just the grease fitting **(e)**, the grease fitting may be left in place.

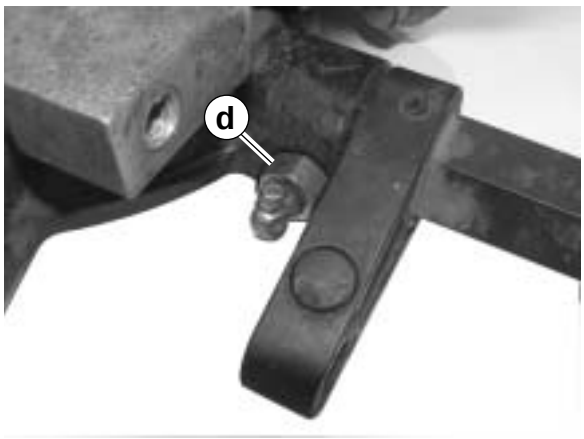
6.3.6 Remove the cotter pin **(f)**, the pivot pin **(g)**, and the blade yoke **(h)** from the machine. Remove the roller guides **(i)** if necessary.

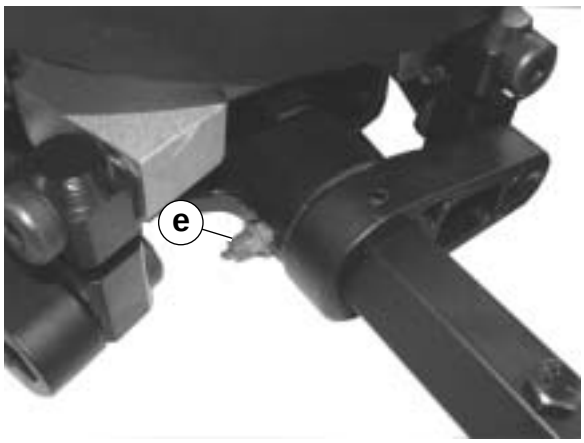
6.3.7 Remove the plug **(j)** from the spider. Remove the bolt **(k)** and washer **(l)** and remove spider **(m)** from the gearbox.

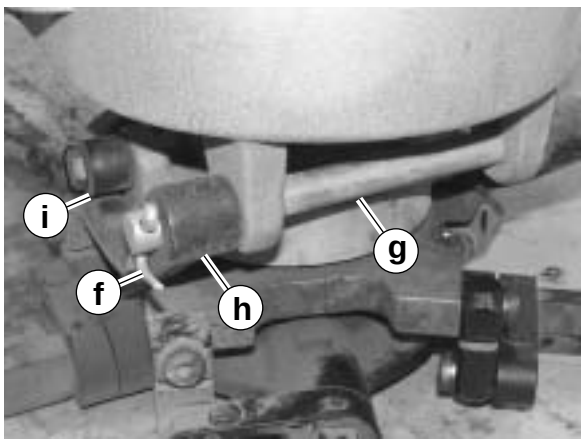
6.3.8 Remove the lift ring assembly **(n)**.

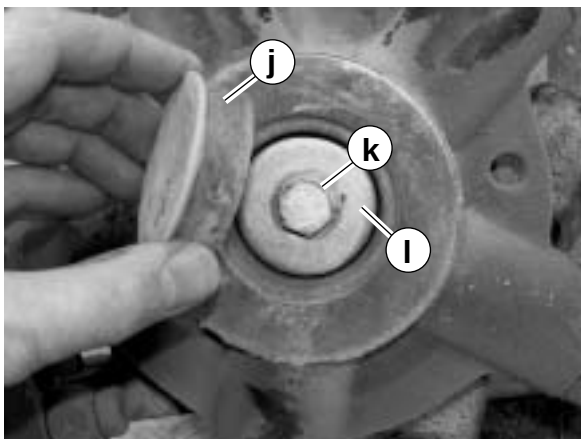
6.3.9 Repeat these steps for the opposite gearbox.











wc_gr003422

Installation:

6.3.10 Position the lift ring assembly **(n)** onto the gearbox.

6.3.11 Place the spider **(m)** onto the lift ring assembly and secure it with the bolt **(k)** and washer **(l)**. Install the plug **(j)** to the spider.

6.3.12 Install the blade yoke **(h)** with the pivot pin **(g)** and the cotter pin **(f)**. Install the roller guides **(i)** if they were removed. When installing the roller guides, use Loctite 271 or an equivalent on the bolt. Tighten the bolt so that the roller guides are tight, then back off the bolt just enough so the roller guides can turn.

6.3.13 Install the arms into the spider.

6.3.14 Secure the blades to each arm with three screws.

CAUTION

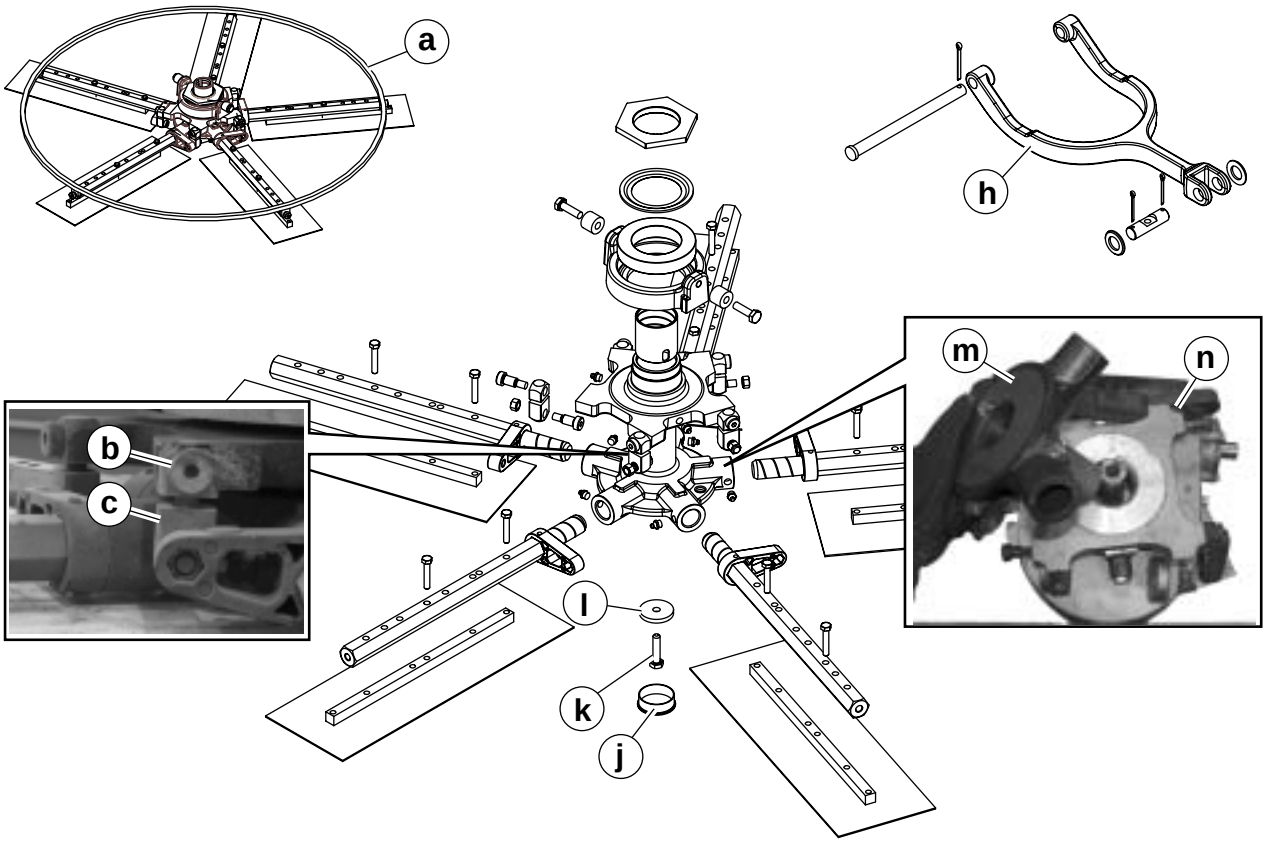
The blades may have sharp edges that can cut. Wear an appropriate pair of gloves when installing the blades.

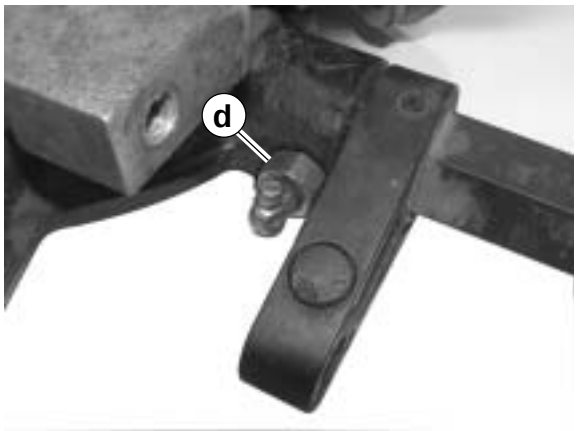
6.3.15 Secure the lifting links to the lift ring assembly with the shoulder bolts **(b)**.

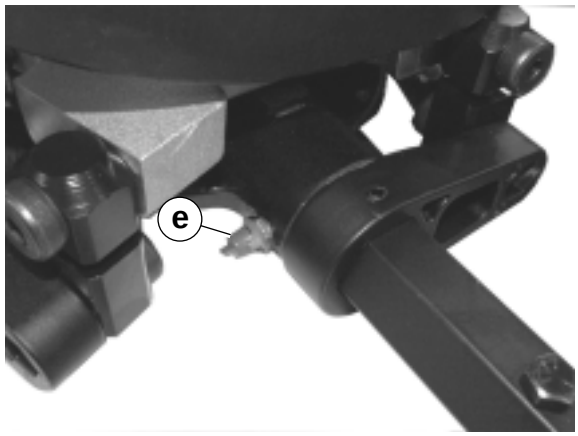
6.3.16 On machines with stabilizer rings **(a)**, secure the stabilizer ring to the arms with the shoulder bolts.

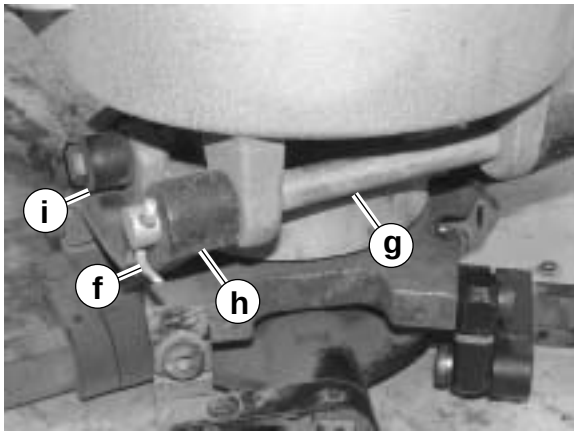
6.3.17 Install the gearbox(es) to the machine. See section *Gearbox Removal and Installation.*

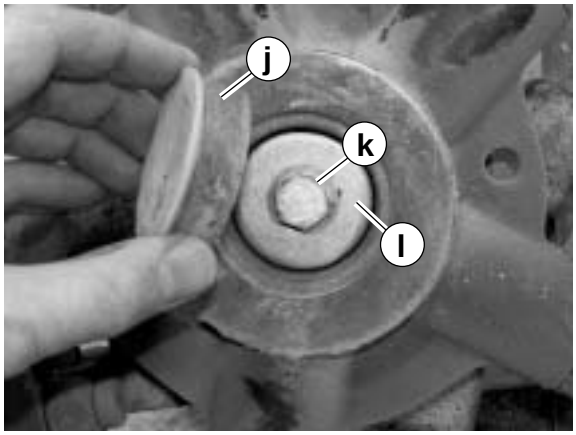
6.3.18 Adjust the blade pitch. See section *Adjusting Blade Pitch.*











wc_gr003422

6.4 Lift Ring Disassembly and Assembly

See Graphic: wc_gr003424

Disassembly:

6.4.1 Remove the gearbox. See section *Gearbox Removal and Installation*.

6.4.2 Remove the spider. See section *Spider Removal and Installation*.

6.4.3 Remove the lift ring assembly **(a)** from the spider.

6.4.4 Clamp the lift ring assembly securely in a vise and remove the lift cap **(b)** by unthreading it.

6.4.5 Remove the seal ring **(c)** and the bearing holder **(d)**.

6.4.6 Press the bearing **(e)** from the bearing holder.

6.4.7 Press the bushing **(f)** from the lift ring.

6.4.8 Remove the roller guides **(g)** if necessary.

Assembly:

6.4.9 Press the bushing **(f)** into the lift ring.

6.4.10 Press the bearing **(e)** into the bearing holder **(d)**.

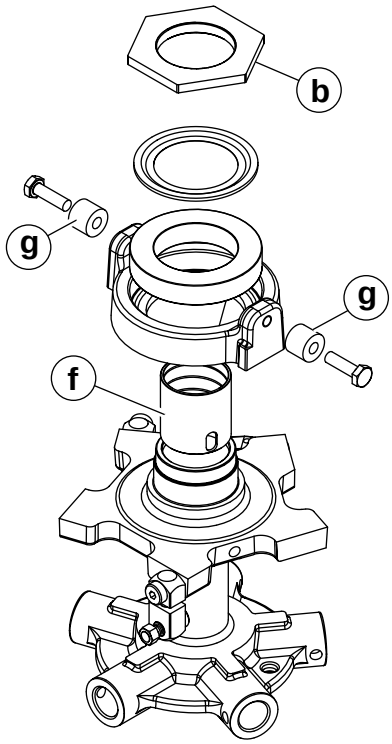
6.4.11 Apply anti-seize to the threads and bearing area of the lift ring **(x)**.

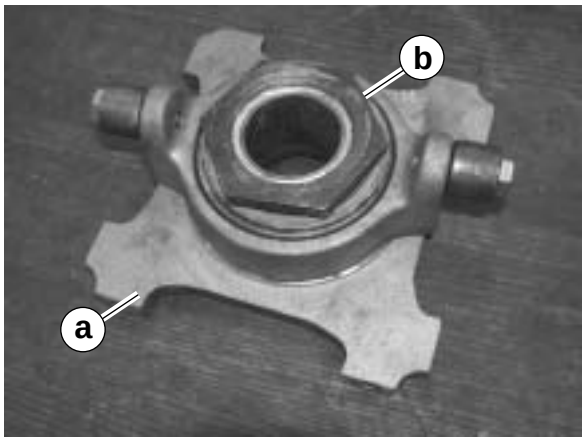
6.4.12 Slide the bearing holder and the bearing onto the lift ring.

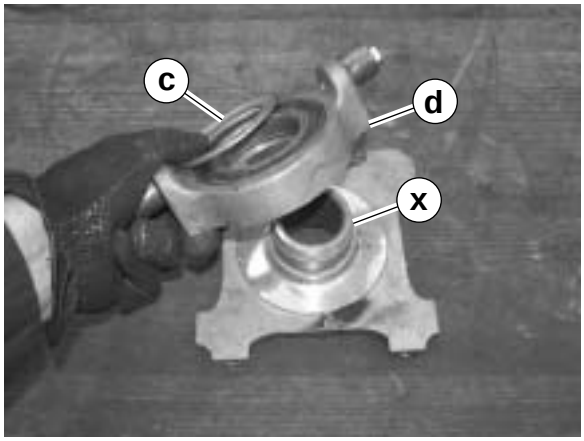
6.4.13 Thread the lift cap **(b)** onto the lift ring and tighten it.

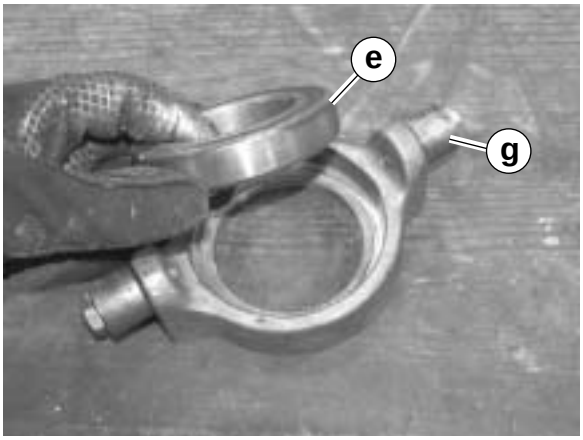
6.4.14 Install the roller guides **(g)** if they were removed. When installing the roller guides, use Loctite 271 or an equivalent on the bolt. Tighten the bolt so that the roller guides are tight, then back off the bolt just enough so the roller guides can turn.

6.4.15 Install the lift assembly onto the spider.









wc_gr003424

6.5 Adjusting Blade Angle

See Graphic: wc_gr003425

There are two methods that may be used to determine blade pitch. The angle gauge method is recommended. The alternative to the angle gauge method is the combination square method.

Angle gauge method (1):

6.5.1 Set the trowel on a flat surface and install the new blades.

6.5.2 Turn the blade pitch controls until the blades are at one-half the maximum pitch.

6.5.3 Check the angle of each blade by placing an angle gauge **(a)** along the front edge of the blade.

6.5.4 Adjust each blade arm as needed to match the measurement. To adjust the blade arms, remove the shoulder bolt **(b)** and turn the link **(c)** to increase or decrease the blade angle.

Note: *All blades must be set at the same angle for correct operation.*

6.5.5 Once all blade angles have been set, apply Loctite 243 or an equivalent to each shoulder bolt and tighten it. Torque the shoulder bolts to 24 Nm (18 ft.lbs.).

Combination square method (2):

6.5.6 Set the trowel on a flat surface and install the new blades.

6.5.7 Turn the blade pitch controls until the blades are at one-half the maximum pitch.

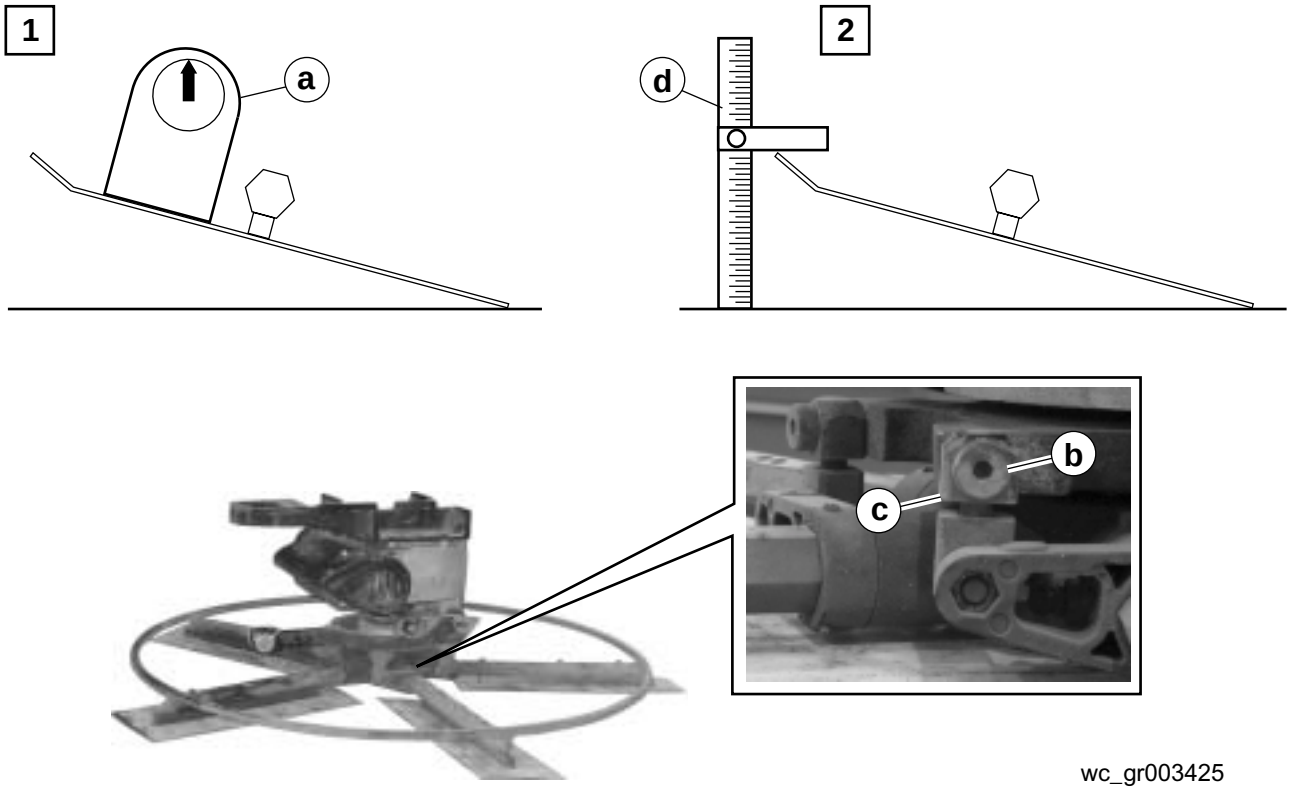
6.5.8 Position a combination square **(d)** as shown. With the combination square positioned against the front (raised) edge of the trowel blade, slide the moveable portion of the combination square down until it contacts the top edge of the trowel blade. Once in place, lock the moveable portion in place.

6.5.9 Check each of the other blades against this measurement.

6.5.10 Adjust each blade arm as needed to match the measurement. To adjust the blade arms, remove the shoulder bolt **(b)** and turn the link **(c)** to increase or decrease the blade angle.

Note: *All blades must be set at the same angle for correct operation.*

6.5.11 Once all blade angles have been set, apply Loctite 243 or an equivalent to each shoulder bolt and tighten it. Torque the shoulder bolts to 24 Nm (18 ft.lbs.).



wc_gr003425

6.6 Gearbox Disassembly

See Graphic: wc_gr003426

This procedure requires a hammer-type gear puller.

6.6.1 Remove the gearbox from the machine. See section *Gearbox Removal and Installation.*

6.6.2 Remove the spider assembly from the gearbox. See section *Spider Removal and Installation.*

6.6.3 Remove the drain plug **(a)** and allow the oil to drain out of the gearbox. It may be necessary to remove the oil fill plug **(b)** to facilitate draining. Open or remove pressure relief valve **(c)** if needed.

Note: *In the interests of environmental protection, place a plastic sheet and a container under the machine to collect any liquid that drains off. Dispose of this liquid in accordance with environmental protection legislation.*

6.6.4 For 48-inch models:

- Remove the screws **(e)** and washers that secure the protective guard **(d)** and remove the protective guard from the gearbox.
- Remove the center screw **(f)** and washer that secure the fan **(g)** and remove the fan.

6.6.5 Remove the screws that secure each seal cover **(h)** to the gearbox and remove the seal covers. Also remove the shim(s) and the O-ring. Press the seal from each cover.

6.6.6 Remove the bolts **(i)** from the top cover **(j)** and remove the top cover. Also remove the shim(s) **(k)** and the O-ring **(l)**.

6.6.7 Remove the output shaft **(m)** from the gearbox. To do so, rotate the input shaft **(n)** while driving out the output shaft with a rubber hammer.

6.6.8 Support the output gear **(o)** in a press. Press the output shaft from both the output gear and the upper bearing **(p)**.

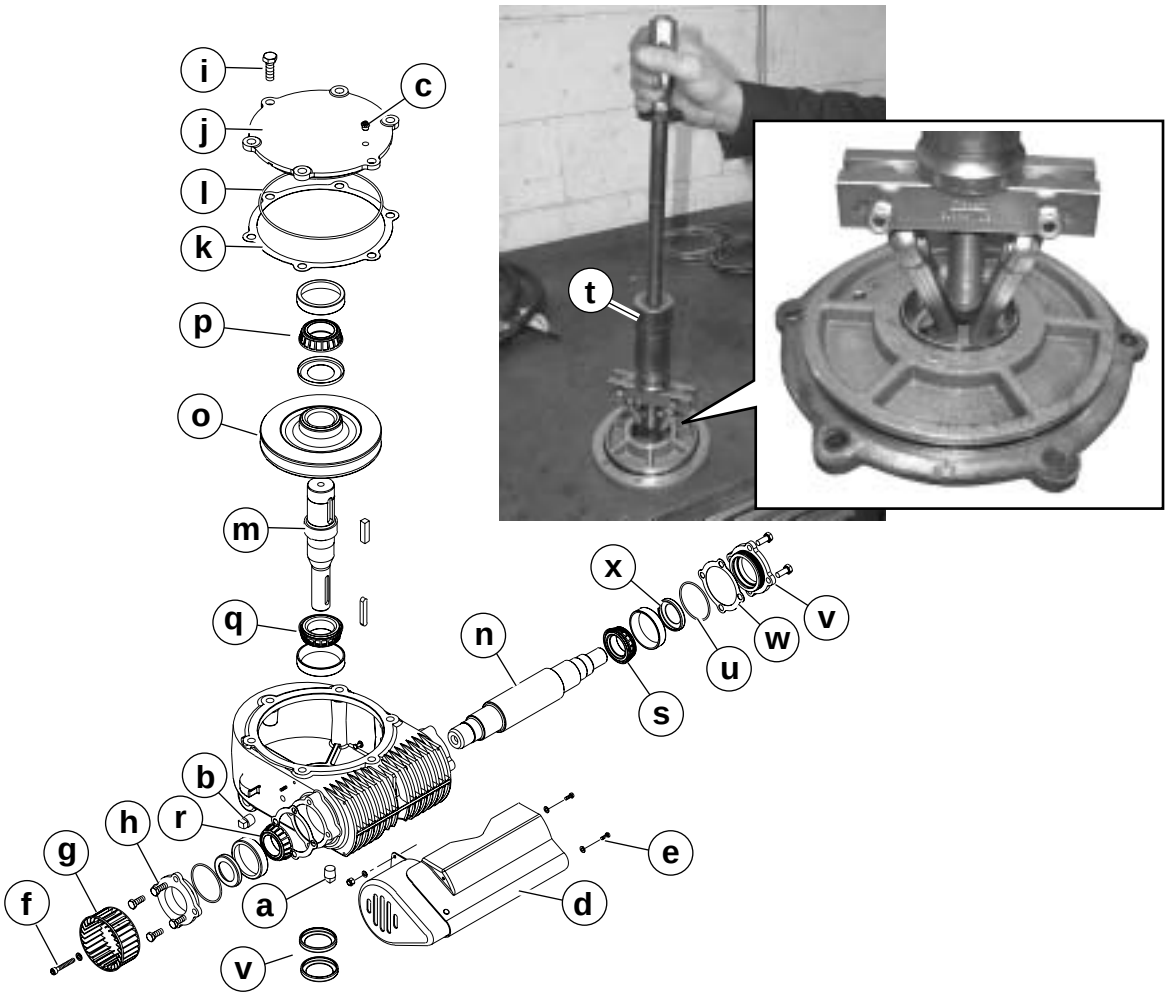
6.6.9 Remove the key and press the lower bearing **(q)** from the output shaft.

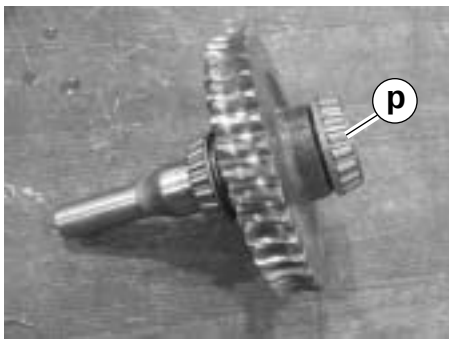
6.6.10 Remove the input shaft **(n)** from the gearbox. To do so, drive it out (in either direction) of the gearbox with a rubber hammer. The corresponding outer bearing race will also be driven out in the process. To remove the opposite-side bearing race, reinsert the shaft and using the rubber hammer, drive the bearing race out of the gearbox by striking the input shaft.

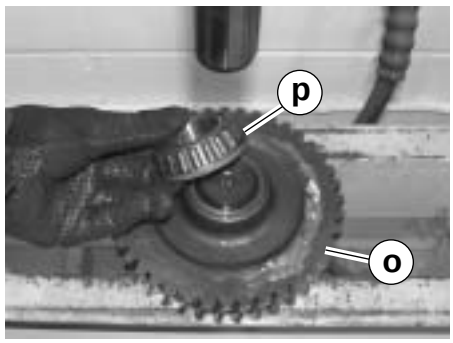
6.6.11 Press the bearings **(r**, **s)** off the input shaft **(n)**.

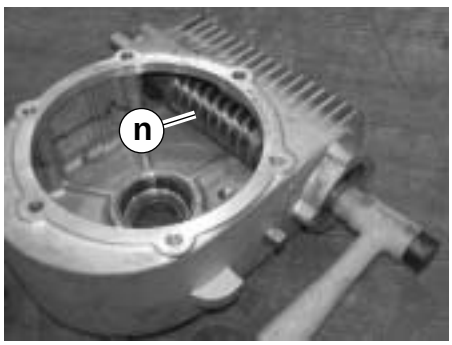
6.6.12 Using a hammer-type puller **(t)**, remove the outer bearing race from the gearbox cover (CT Trowel gearbox cover shown). Use the same technique to remove the outer bearing race from the gearbox.

6.6.13 Remove the two seals **(v)** from the gearbox.









wc_gr003426

6.7 Gearbox Assembly

See Graphic: wc_gr003427

6.7.1 Install two new seals **(v)** into the gearbox.

6.7.2 Press the outer bearing races into the gearbox and the gearbox cover.

6.7.3 Press the bearings **(r**, **s)** onto the input shaft **(n)**.

6.7.4 Oil the bearings on the input shaft and place the input shaft into the gearbox.

6.7.5 Press the lower bearing **(q)** onto the output shaft **(m)**.

6.7.6 Press the output gear **(o)** and the upper bearing **(p)** onto the output shaft.

6.7.7 Pack the upper bearing of the output shaft with grease. Oil the lower bearing of the output shaft.

6.7.8 Insert the output shaft into the gear box.

6.7.9 Install the outer bearing races of the input shaft into the gearbox by tapping them in with a rubber mallet. Tap them in so that they are flush with the outside of the gearbox housing.

6.7.10 On the coupling side of the input shaft, install the O-ring **(u)** and seal **(x)** into the cover **(v)**. Then, install the cover and any shims **(w)** that were removed to the gearbox with screws. Torque the screws to 25 Nm (18 ft.lbs.).

6.7.11 On the fan side of the input shaft, install the O-ring and seal into the cover **(h)**. Then, install the cover and any shims that were removed. Tap each end of the input shaft with a rubber mallet to set the bearings. Check the shaft for end play. The maximum allowable end play is 0.05 mm (0.002 in.). Add or remove shims as needed. Once set, torque the screws to 25 Nm (18 ft.lbs.).

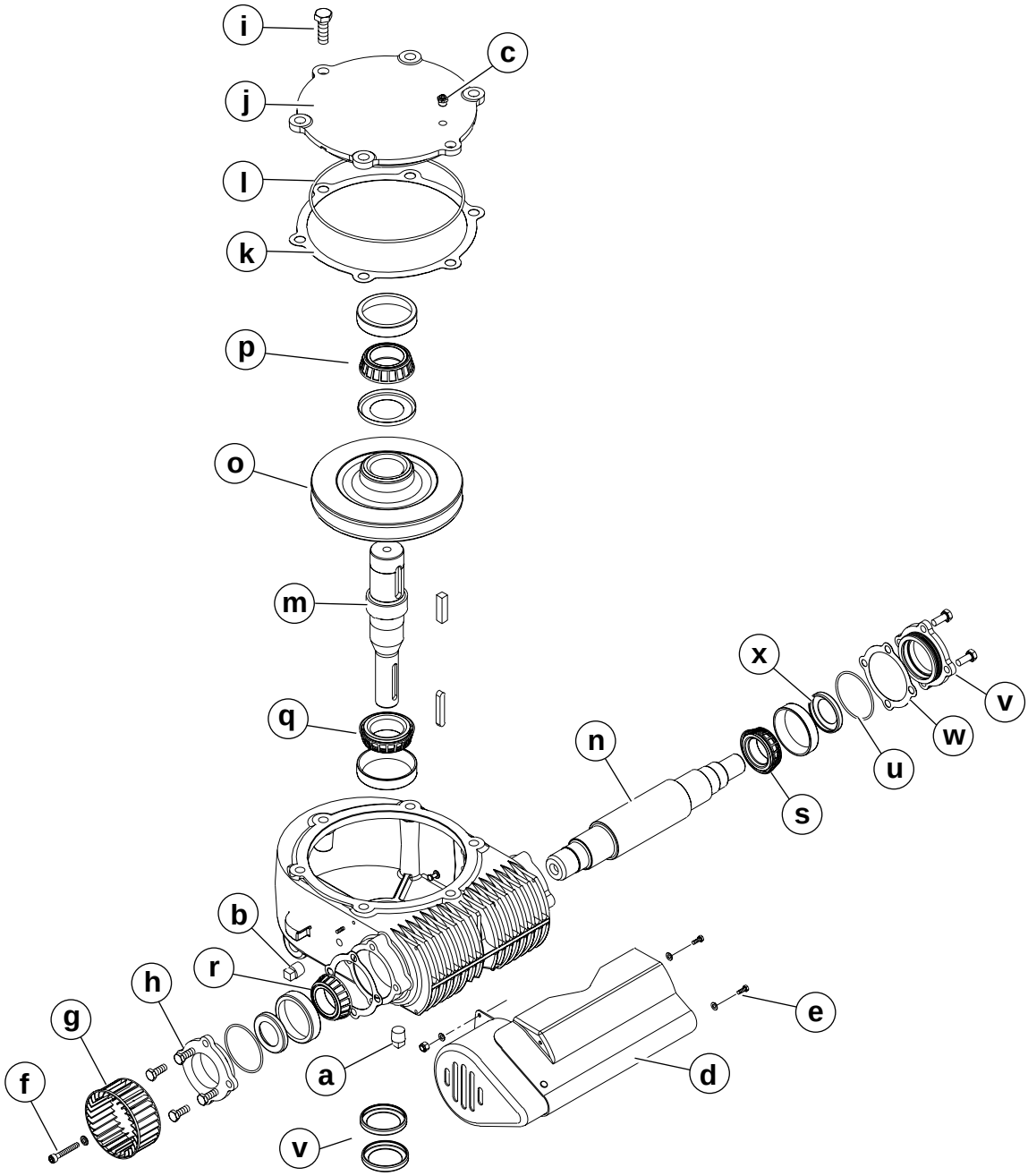
6.7.12 Install the O-ring and the pressure relief valve (if it was removed) to the top cover. Check the shaft for side play. The maximum allowable side play is 0.05 mm (0.002 in.). Add or remove shims as needed. Once set, apply Loctite 243 or an equivalent to the screws and torque the screws to 86 Nm (63 ft.lbs.).

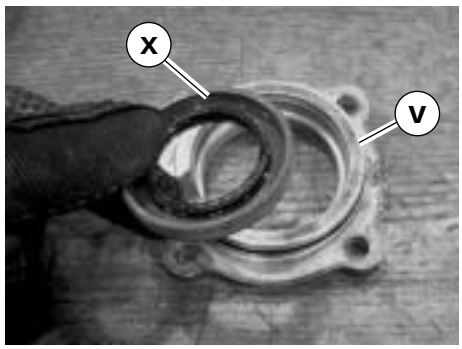
6.7.13 Apply Loctite 545 or an equivalent to the oil drain plug and install the oil drain plug.

6.7.14 With the gearbox level, fill it with approximately 1.8 liters (62 oz.) of Glycoyle synthetic gear oil. DO NOT overfill the gearbox with oil. Wipe the threads of the gearbox and the oil fill plug dry. Apply Loctite 545 or an equivalent to the fill plug and install it into the gearbox. Torque the fill plug to 20 Nm (15 ft.lbs.).

6.7.15 For 48-inch models:

- Install the fan **(g)** with the center screw **(f)** and washer.
- Install the protective guard **(d)** with screws **(e)** and washers.





wc_gr003427

7. Steering and Pitch Control

7.1 Pitch Control Removal and Installation

See Graphic: wc_gr001585

Removal:

7.1.1 Turn off the machine.

7.1.2 Adjust the pitch on the blades so that they lie flat.

7.1.3 Disconnect the wiring to the front light.

7.1.4 Disconnect the pitch cable **(g)** from the lift yoke **(m)** by removing the locknut **(t)**.

7.1.5 Remove the screws **(a)** and the nuts **(b)** securing the pitch control and lift the pitch control from the machine.

7.1.6 Remove the screws **(n)**.

7.1.7 Turn (unscrew) the handle **(r)** to remove it from the pitch control tube **(i)**.

7.1.8 Remove the two spring-loaded balls and springs **(c)** from the housing.

7.1.9 If replacing the cable, remove the index bolt **(h)** and spacer from the cable tube **(f)** and slide it out of the pitch control tube.

7.1.10 Press the pin **(k)** out of the pitch control tube far enough to remove the cable.

Installation:

7.1.11 If the pitch cable **(g)** was removed, insert the pitch cable into the cable tube **(f)** and secure it with the pin **(k)**.

7.1.12 Slide the cable tube **(f)** into the pitch control tube **(i)**. Apply Loctite 243 or an equivalent to the index bolt **(h)** and install it and the spacer into the cable tube.
Note: *There are specific cable tubes and screws for each side (left or right) of the machine. Be sure to use the correct ones for the particular side of the machine you are working on.*

7.1.13 Lightly grease the spring-loaded balls and the springs **(c)** and install them into the pitch control tube.

7.1.14 Lightly grease the threaded shaft **(e)** and screw it into the cable tube **(f)**.

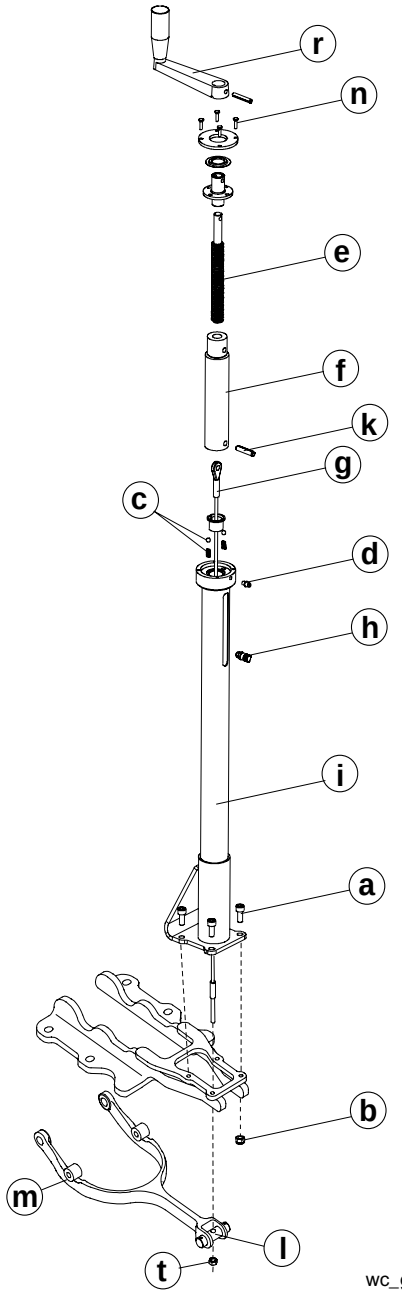
7.1.15 Gently seat the crank handle assembly onto the spring-loaded balls **(c)**. Apply Loctite 243 or an equivalent to the screws **(n)** and secure the crank handle assembly to the pitch control tube. Torque the screws to 2.94 Nm (26 in.lbs.).

7.1.16 Apply Loctite 243 or an equivalent to the screws **(a)** and install the pitch control tube labeled “L” on the left-side gearbox pivot and the pitch control tube labeled “R” on the right-side gearbox pivot. Torque the screws to 25 Nm (18 ft.lbs.).

Note: *Left and Right are defined from the operator’s position.*

7.1.17 Insert the threaded end of the pitch cable into the pitch cable mount **(l)**. With the handle cranked to the lowest position and the blades flat (0° pitch), lift the yoke **(m)** until it contacts the rollers. Then, thread on the locknut **(t)** until it contacts the pitch cable mount **(l)**.

7.1.18 Be sure that the blades are flat and all slack is removed from the cable.



wc_gr001585

7.2 Removing and Installing the Manual Steering System—CRT 36

See Graphic: wc_gr003443

Removal:

7.2.1 Turn off the machine and disconnect the battery.

7.2.2 Unplug the wiring harness **(a)**.

7.2.3 Remove the bolts **(b)** securing the steering levers **(d)** to the handle mounts **(c)** and remove the steering levers.

7.2.4 Remove the screws from the front grill and remove the front grill.
Note: *On some models you will need to disconnect the water pump before removing the front grill.*

7.2.5 Remove the bolts **(d**, **e)** and the spacers **(f)** from the bottom of each handle mount **(c)**.

7.2.6 Remove the nuts **(z)** and remove each handle mount.

7.2.7 Remove the bolt **(g)** and the nut **(h)** from each pivot bracket **(i)** on the end of the control shafts **(aa)**.

7.2.8 Remove the screws **(j)** and nuts **(k)** securing the outside bearings **(l)** to the frame and remove the outside bearings and the control shafts.

7.2.9 Remove the screws **(m)** and the nuts **(n)** from the center bearings **(o)** and remove the center bearings.

Installation:

7.2.10 Grease the center bearings **(o)** and attach with screws **(m)** and nuts **(n)**. Torque the screws to 24 Nm (18 ft.lbs.).

7.2.11 Install one side of the control shaft into the center bearings, then secure the other end by attaching the outside bearings **(l)** with screws **(j)** and nuts **(k)**. Torque the screws to 24 Nm (18 ft.lbs.).

7.2.12 Secure the control shaft to the pivot link **(q)** with bolt **(g)** and nut **(h)** at pivot bracket **(i)**.

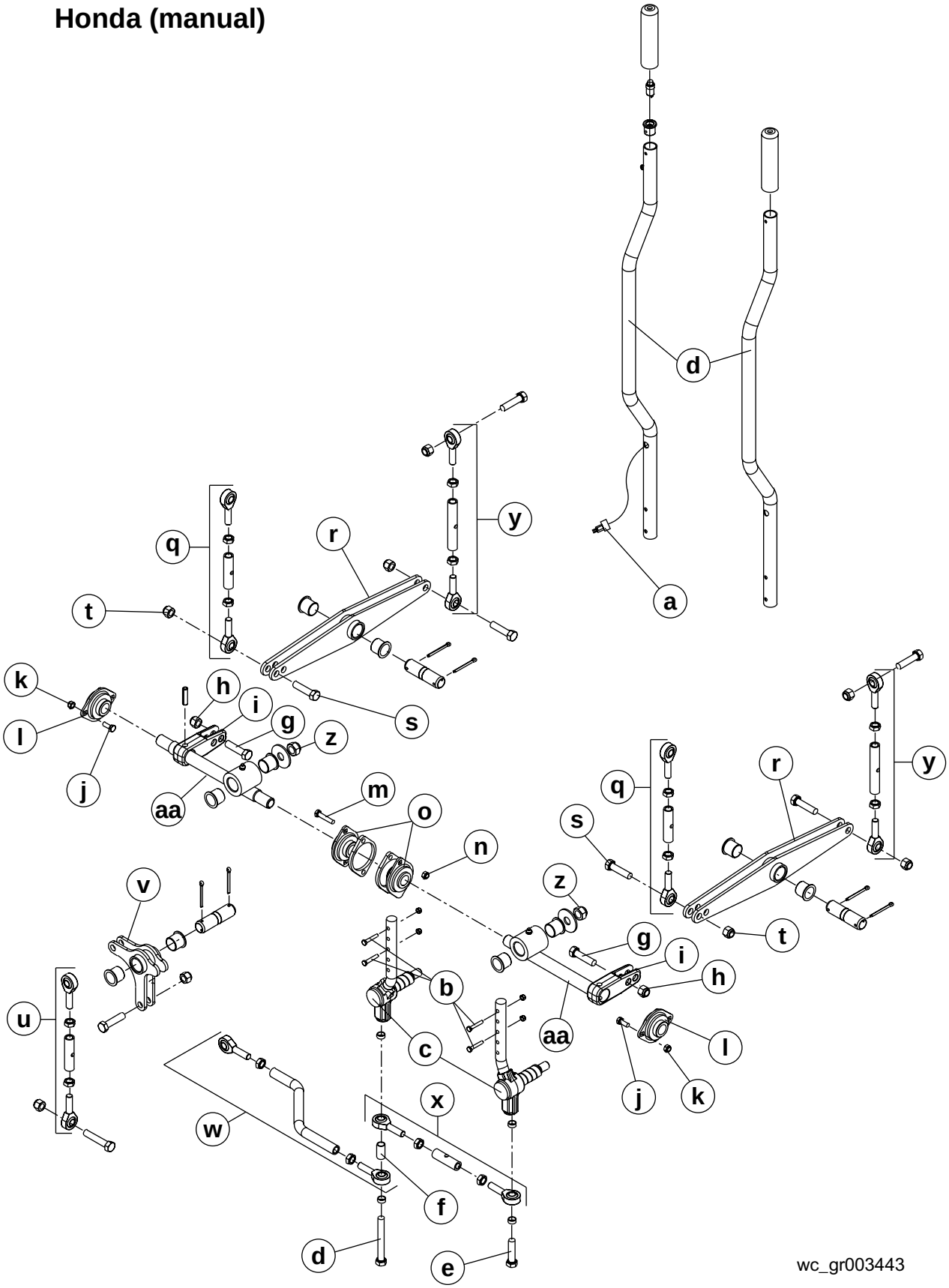
7.2.13 Secure the handle mounts **(c)** to the control shafts with nuts **(z)**.

7.2.14 Attach each steering lever **(d)** to the handle mounts with bolts **(d**, **e)** and spacers **(f)**.

7.2.15 Reconnect the wiring harness **(a)**.

7.2.16 Attach the front grill and reconnect the water pump if it was disconnected.

Honda (manual)



7.3 Removing and Installing the Manual Steering System—CRT 48

See Graphic: wc_gr003443, wc_gr003444

Removal:

7.3.1 Turn off the machine and disconnect the battery.

7.3.2 Unplug the wiring harness **(a)**.

7.3.3 Remove the bolts **(b)** securing the steering levers **(d)** to the handle mounts **(c)** and remove the steering levers.

7.3.4 Remove the screws from the front grill and remove the front grill.
Note: *On some models you will need to disconnect the water pump before removing the front grill.*

7.3.5 Remove the bolts **(d**, **e)** and the spacers **(f)** from the bottom of each handle mount **(c)**.

7.3.6 Remove the nuts **(z)** and remove each handle mount.

7.3.7 Remove the bolt **(g)** and the nut **(h)** from each pivot bracket **(i)** on the end of the control shafts **(aa)**.

7.3.8 Remove the screws **(j)** and nuts **(k)** securing the outside bearings **(l)** to the frame and remove the outside bearings and the control shafts.

7.3.9 Remove the screws **(m)** and the nuts **(n)** from the center bearings **(o)** and remove the center bearings.

Installation:

7.3.10 Grease the center bearings **(o)** and attach with screws **(m)** and nuts **(n)**. Torque the screws to 24 Nm (18 ft.lbs.).

7.3.11 Install one side of the control shaft into the center bearings, then secure the other end by attaching the outside bearings **(l)** with screws **(j)** and nuts **(k)**. Torque the screws to 24 Nm (18 ft.lbs.).

7.3.12 Secure the control shaft to the pivot link **(q)** with bolt **(g)** and nut **(h)** at pivot bracket **(i)**.

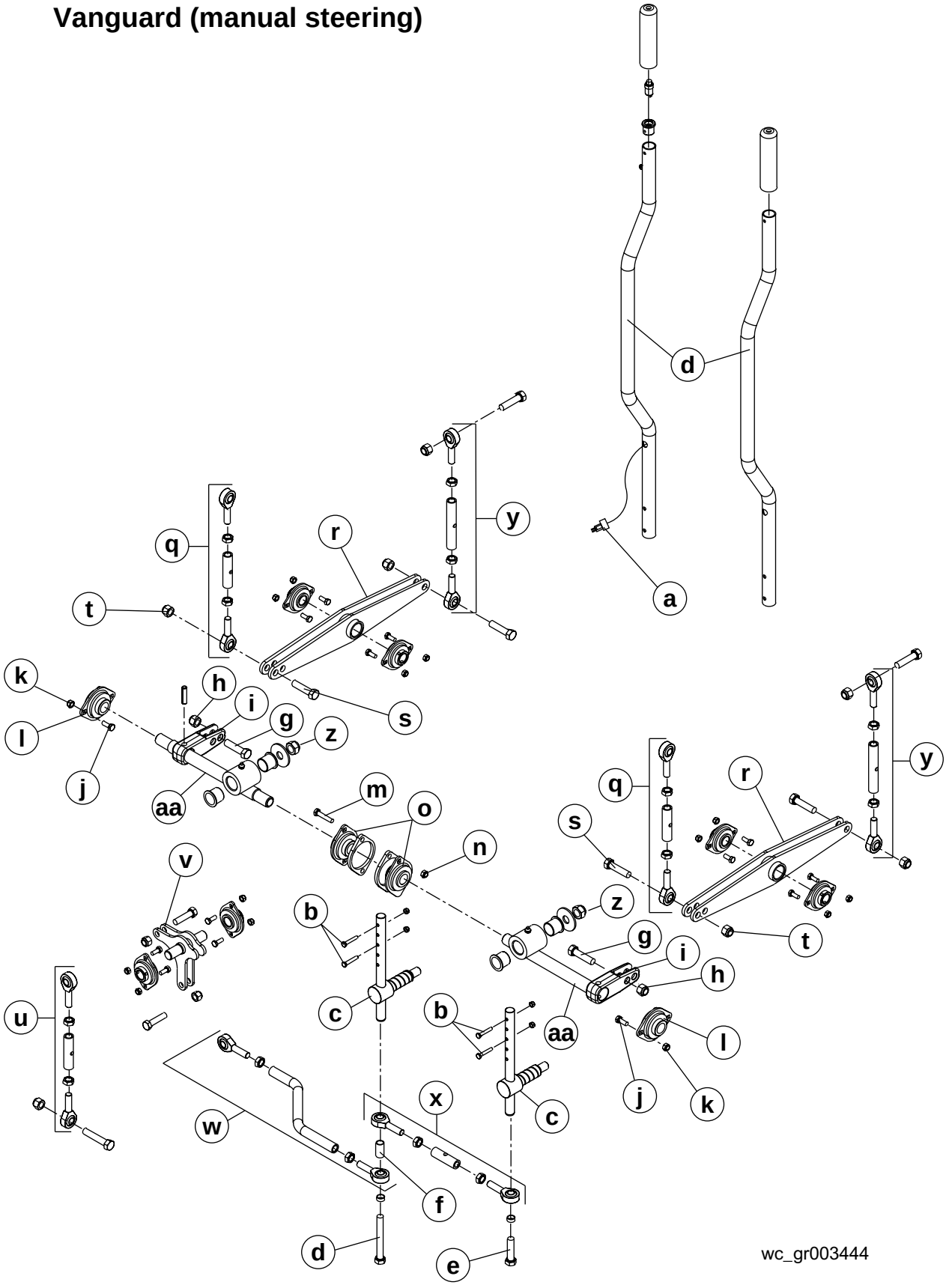
7.3.13 Secure the handle mounts **(c)** to the control shafts with nuts **(z)**.

7.3.14 Attach each steering lever **(d)** to the handle mounts with bolts **(d**, **e)** and spacers **(f)**.

7.3.15 Reconnect the wiring harness **(a)**.

7.3.16 Attach the front grill and reconnect the water pump if it was disconnected.

Vanguard (manual steering)



7.4 Adjusting Control Arm Pitch (forward or backward)

See Graphic: wc_gr003458

For most operators, the optimum position for the control arms **(f)** is for them to lean (pitch) forward slightly—approximately 5°. Both control arms should lean forward the same amount. To adjust the position of the control arms, carry out the following procedure:

7.4.1 Loosen the jam nuts **(b)**.

7.4.2 Turn the vertical linkage **(a)** as follows:

- Extend the linkage to adjust the control arms forward.
- Shorten the linkage to adjust the control arms backward.

7.4.3 After the control arms have been adjusted to the desired position, tighten the jam nuts **(b)**. Torque the jam nuts to 75 Nm (55 ft.lbs.).

7.5 Adjusting the Right-hand Control Arm (right or left)

See Graphic: wc_gr003458

The right-hand arm should be set to be perfectly parallel to the left-hand arm. Should the arms come out of adjustment, adjust the right-hand arm as follows:

7.5.1 Remove the nut and bolt **(c)**.

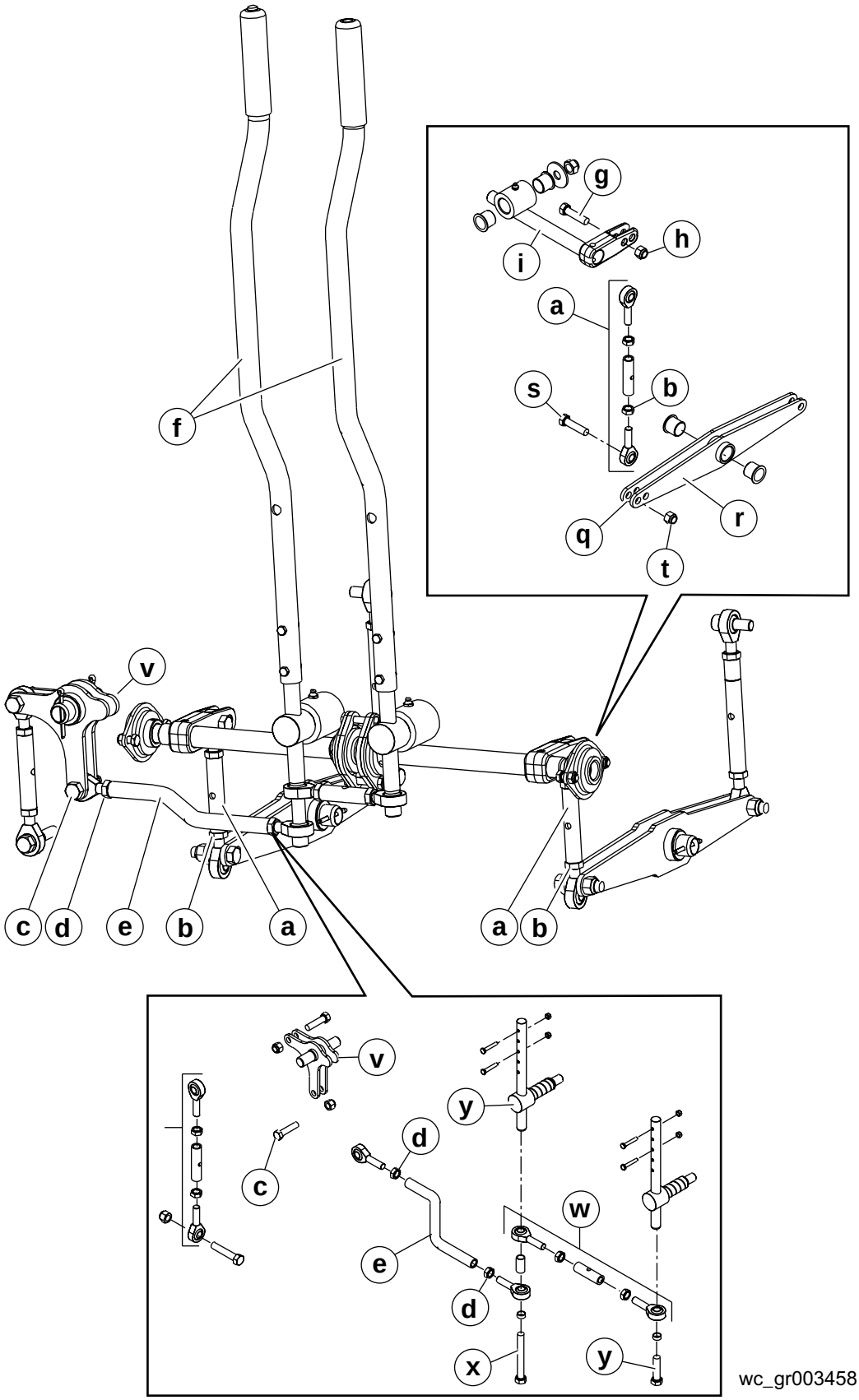
7.5.2 Loosen the jam nuts **(d)**.

7.5.3 Drop the horizontal linkage **(e)** down to clear the bracket.

7.5.4 Shorten the linkage to move the control arm to the left.

7.5.5 Extend the linkage to move the control arm to the right.

7.5.6 After the control lever has been adjusted to the desired position, reassemble the nut and the bolt **(c)** and tighten the jam nuts **(d)**.



wc_gr003458

7.6 Adjusting Steering Arm Responsiveness

See Graphic: wc_gr003458

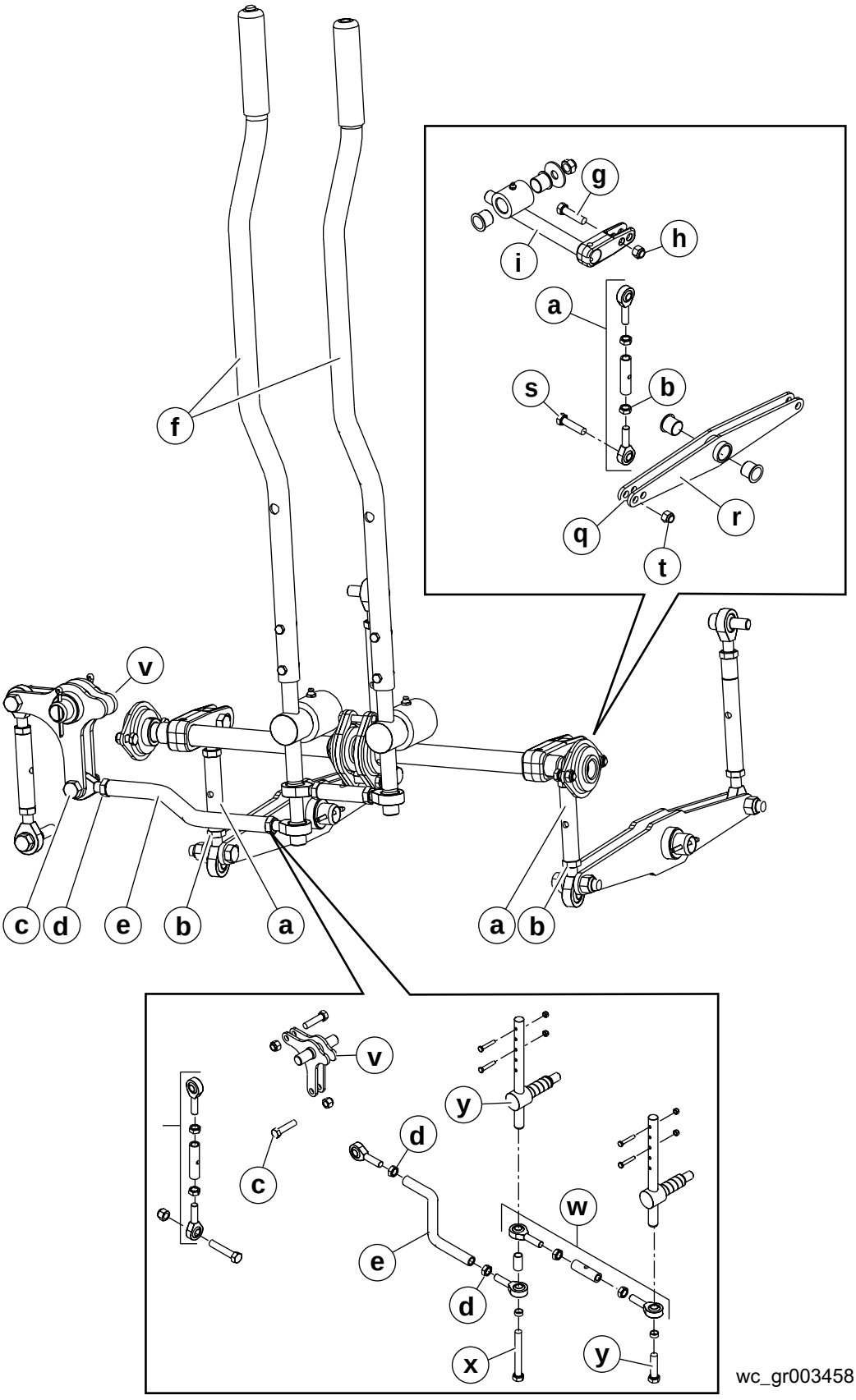
The responsiveness of the steering arms can be adjusted by changing the connection point where the adjustable links **(a)** are mounted to the steering pivots **(r)**. The connection point of the adjustable links can be moved between the front and the rear mounting holes **(q)** of the steering pivot. Connecting the adjustable link in the front hole will decrease the effort required by the operator to move the steering arms but will increase the amount of travel of the steering arms required. Connecting the adjustable link in the rear hole will increase the amount of effort required to move the steering arms but will lessen the amount of travel required. To adjust the steering arm responsiveness, carry out the following procedure:

7.6.1 Locate the forward/reverse steering pivots **(r)** and the left/right adjustable links **(a)**.

7.6.2 If necessary, adjust the forward/reverse steering pivots **(r)** so that they are horizontal when the machine is at rest. To do so, loosen the jam nuts on the pivot links **(q** and **y)** and turn the links in or out to level the steering pivots. Once the steering pivots are horizontal, torque the jam nuts to 77 Nm (57 ft.lbs.).

7.6.3 Disconnect the attaching bolts **(s)** and nuts **(t)**. Move the adjustable link to the desired hole in the steering pivots and reattach the bolts and nuts. Torque the nuts **(t)** to 75 Nm (55 ft.lbs.).

7.6.4 If the connection point of the adjustable links is changed at the steering pivots, a corresponding change in the connection point at the upper pivot bracket **(i)** will also need to be made. Disconnect the attaching bolts **(g)** and nuts **(h)**. Move the adjustable link to the desired hole in the upper pivot bracket and reattach the bolts and nuts. Torque the nuts **(t)** to 75 Nm (55 ft.lbs.).



wc_gr003458

7.7 Centering the Steering Arms

See Graphic: wc_gr003458

The pivot bracket **(v)** is the connection point between the gearbox and the control arm. When the machine is at rest, the pivot bracket must be in a horizontal position and the right control arm should be in a vertical position 90° to the pivot bracket. Adjusting the steering arms in this manner is referred to as centering the steering arms. To center the steering arms, carry out the following procedure:

7.7.1 Loosen the jam nuts **(d)** on the left/right pivot link **(e)** and turn the pivot link until the left pivot bracket **(v)** is horizontal. Once the pivot link is horizontal, torque the jam nuts to 75 Nm (55 ft.lbs.).

7.7.2 If the steering arms are not centered (90° to the pivot bracket), loosen the jam nuts on the offset pivot link **(w)** and remove the bolt **(x)** from the bottom of the steering handle. Adjust (turn) the handle mount **(y)** until the steering arms are centered, then reinstall the bolts into the bottom of the steering arms. Torque the jam nuts on the offset pivot link to 75 Nm (55 ft.lbs.).

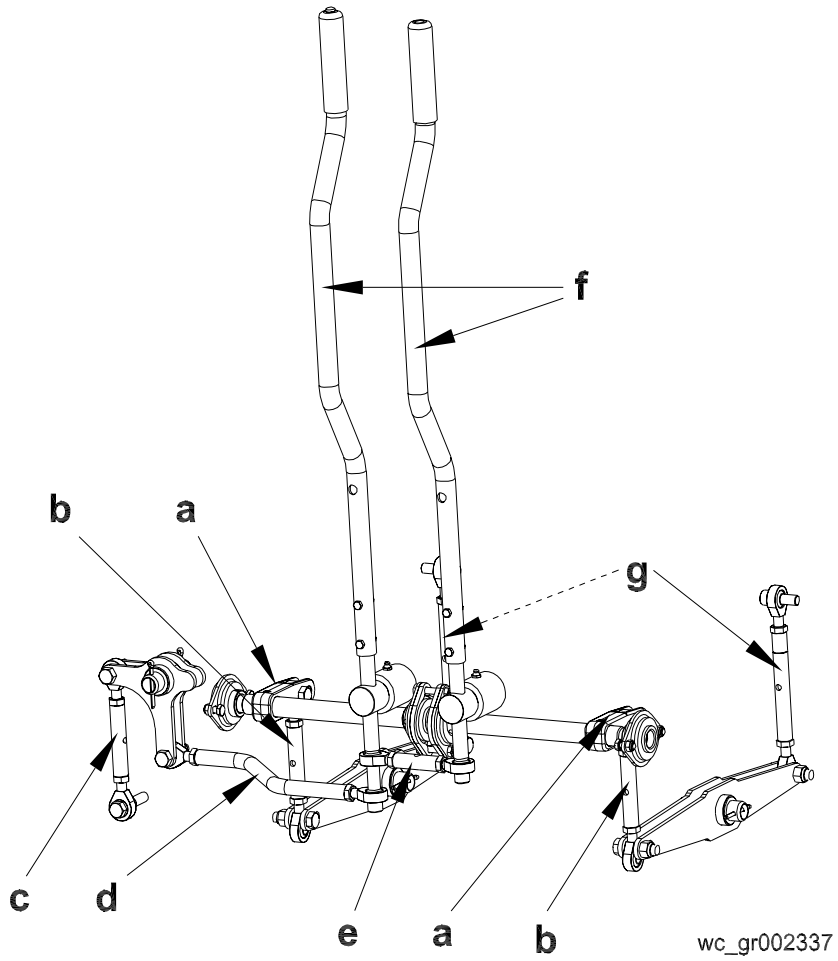
If the operator prefers more distance between the steering arms, adjust the steering handle spacing. To do so, carry out the following procedure:

7.7.3 Loosen the jam nuts on the offset pivot link **(w)**.

7.7.4 Remove the bolts **(x**, **y)** from the bottom of the handle mounts.

7.7.5 Adjust (turn) the handle mounts to increase or decrease the width between the control arms. Then, tighten the jam nuts on the offset pivot link. Torque the jam nuts and bolts to 75 Nm (55 ft.lbs.).

7.8 Adjustment Values for the Manual Steering System



Ref.	Description	Ref.	Description
a	Tilts down 5° when steering handles are tilted towards seat	e	CRT 48: 13.97 cm (5-1/2 in.) CRT 36: 12.70 cm (5 in.) between center lines of tie-rods
b	16.83 cm (6-5/8 in.) between center lines of tie-rods	f	Tilt steering handles towards seat: 5° Spread steering handles towards rotors: CRT 48: 2°–3° CRT 36: 4°–5°
c	15.88 cm (6-1/4 in.) between center lines of tie-rods	g	19.37 cm (7-5/8 in.) between center lines of tie-rods
d	CRT 48: 48.26 cm (19 in.) CRT 36: 35.88 cm (14-1/8 in.) between center lines of tie-rods		

7.9 Electric Steering System Background

See Graphic: wc_gr003372

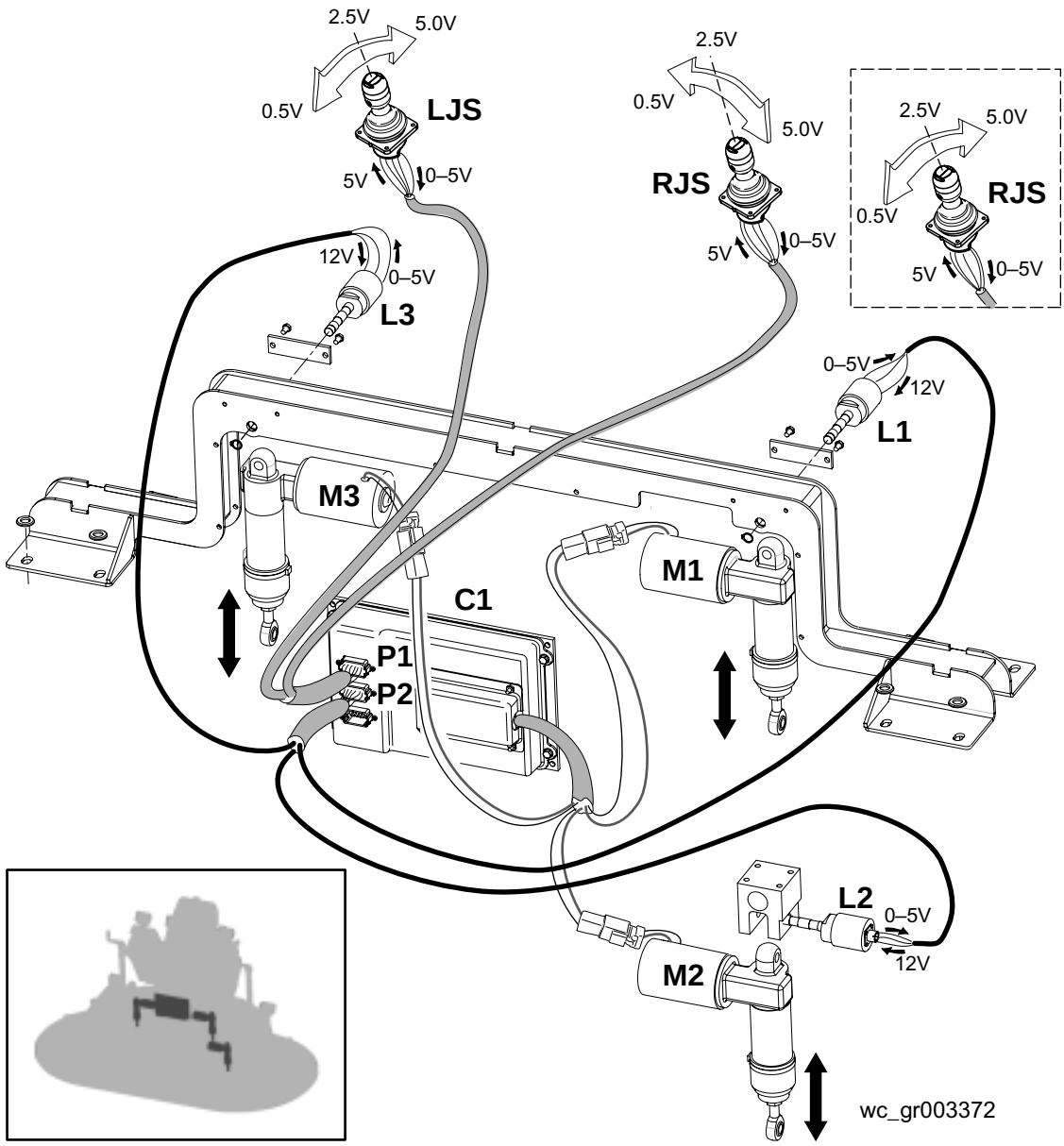
Movement of the trowel is dependent on the angle of the gearboxes. The actuators are the mechanical devices which adjust the angle of each gearbox. An electric motor mounted to each actuator spins and as it does it turns the actuator's main drive screw in or out. This movement of the actuator's main drive screw changes the angle of the gearbox.

Control of power to the actuator motors is done through electric signals (voltages) sent and received between the major components of the system: the joysticks, the control board, the actuator motors, and the load pins.

When the ignition key is in the ON position, the joysticks receive 12VDC from the control board and feed back 0–5VDC depending on their position. In the home position (neutral), they hold a 2.5VDC charge. In the full-forward position, the voltage approaches 5VDC; in the full-backward position, the voltage drops to approximately 0.5VDC.

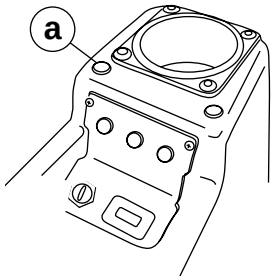
The load pins are also fed 12VDC from the control board and feed back 0–5VDC. The amount of voltage fed back to the control board depends on the amount of force applied to them by the actuator. The greater the pressure, the greater the voltage feedback to the control board. In the home position (neutral) the load pins are preloaded and hold a 2.5VDC charge. As the angle of the gearbox changes, so does the pressure on the load pin. When the gearboxes are tilted forward, the pressure on the load pins decreases. This decrease in pressure translates into a decrease in the feedback voltage to the control board. When the gearboxes are tilted backward, the pressure on the load pins increases. This increase in pressure increases the feedback voltage to the control board.

For every feedback voltage from the joysticks, the control board is programmed to expect a specific feedback voltage from the load pins. For every position of the joysticks, the control board will send voltage to the appropriate actuator motor until the pressure on the load pin translates into the expected feedback voltage for the given position; at which point, voltage to the actuator motor ceases and actuator movement stops.



Ref.	Description	Ref.	Description
M1	Right actuator motor	**L1**	Right load pin
M2	Side actuator motor	**L2**	Side load pin
M3	Left actuator motor	**L3**	Left load pin
P1	Gray, control board connector	**C1**	Control board
P2	Black, control board connector	**LJS**	Left joystick
-	---	**RJS**	Right joystick

7.10 “Limp Home” Mode

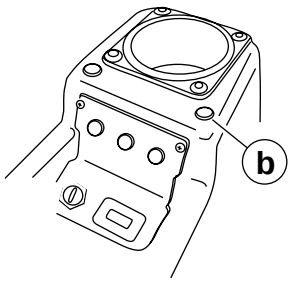


wc_gr003380

During normal operation, the green status indicator light **(a)** will remain on. When the green status indicator light flashes, this indicates the trowel is operating in the “limp home” mode. The “limp home” mode signifies a fault with the load pin(s). In the “limp home” mode, the load pins no longer provide feedback to the microprocessor. This condition can occur if a load pin is damaged, its wiring has an open circuit, or its wiring has a short circuit. The “limp home” mode is designed to allow the operator to continue steering the trowel, at a reduced level of control, until a repair can be made. In the “limp home” mode, the actuators are still driven in or out by joystick movement; however, the actuator does not return to the home (center) position when the joystick is released. There is no automatic home (center) position for the actuators; the joysticks must be used for every actuator movement. For example, if the joysticks are positioned in a full forward position, the microprocessor will send voltage to the actuator motor. With no feedback from the load pin, the microprocessor cannot tell when the actuator has reached the desired position and thus will continue to send voltage to the actuator motor as long as the joystick is moved from its home position. When the joystick is released, the joystick returns to its home position; however, the actuators do not. They will remain in the full-forward position. The joysticks must be used to manually bring the actuators back to neutral by oversteering in the opposite direction.

The trowel’s steering system is calibrated at the factory and should not normally require calibrating. However, if a damaged load pin is detected, calibration may be required. Calibration may be done by contacting your local Wacker Corporation authorized service dealer.

7.11 Error Codes



wc_gr003381

The red indicator light **(b)** is used to communicate system faults. A specific sequence of flashes of the red indicator light is used to identify each fault. The sequence of flashes is known as the error code. There are 17 distinct error codes. Error code sequence:

- long pause
- 1 to 4 flashes
- short pause
- 1 to 3 flashes
- short pause
- 1 to 5 flashes

The sequence will repeat as long as there is a fault present. During a multiple-fault condition, the error codes will flash in order of fault priority. After the first fault is corrected, the error code for the second fault will flash and so on, until all faults are corrected.

Ref.	Description	Ref.	Description
111	Right control fault	231	Left load pin open circuit
121	Side control fault	232	Left load pin short circuit
131	Left control fault	311	Right joystick open circuit
211	Right load pin open circuit	312	Right joystick short circuit
212	Right load pin short circuit	321	Left joystick open circuit
213	Right load pin bent	322	Left joystick short circuit
221	Side load pin open circuit	414	Control board over temperature (above 80°C / 176°F)
222	Side load pin short circuit	415	Low battery voltage
223	Side load pin bent		

When an error code is displayed via the red indicator light, record the error code. Before in-depth troubleshooting, carry out the following procedure:

7.11.1 Turn the ignition switch OFF and then back ON again. Check the function of the steering system on all three circuits: right, side, and left.

- If the red indicator light is no longer flashing and the system is functioning, no further action is required.
- If the red indicator light is still flashing, turn the ignition switch OFF and continue.

7.11.2 Use a digital multimeter to check the battery voltage. It must be over 11VDC for proper operation.

- If the battery voltage is under 11VDC, charge or replace it.
- If the battery voltage is 11VDC or more, continue.

7.11.3 Check the 70A maxi-fuse for the steering control system actuators. It is located under the seat pedestal above the relays and ignition module cover.

- If the 70A maxi-fuse is blown, replace it.
- If the 70A maxi-fuse is not blown, continue with in-depth trouble-shooting.

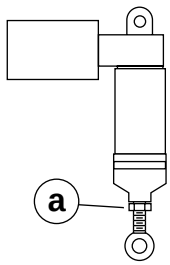
7.12 Error Code 111—Right Actuator Fault

A right actuator fault may be caused by faulty wiring to the actuator motor, a loose actuator jam nut, a faulty actuator motor, or a malfunctioning control board.

7.12.1 Check the condition of the wiring and wire connections at the actuator motor. If necesary, check the continuity of the wiring between the control board and the actuator motor. If the wiring is OK, continue.

7.12.2 Turn the ignition switch ON. Move the right joystick back and forth from its full-forward to its full-reverse positions and watch for movement of the right actuator.

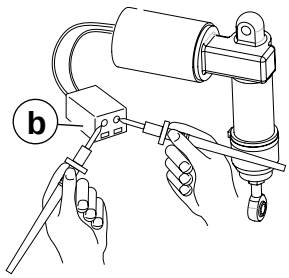
- If there is little or erratic movement, turn the ignition switch OFF. Check that the jam nut **(a)** at the bottom of the actuator cylinder is tight. If the jam nut is loose, the actuator will have erratic or no movement. Apply red Loctite or an equivalent to the jam nut and tighten it. See section *Removal and Installation of Electric Steering Actuators*.
- If the jam nut is tight, continue.



wc_gr003373

7.12.3 To test the actuator motor: Turn the ignition switch OFF. Disconnect the wiring harness from the right actuator motor M1. Use a multimeter and check the resistance of the actuator motor's windings. Do so by probing the connector **(b)**. The resistance should be 0.2–1.0 Ohms.

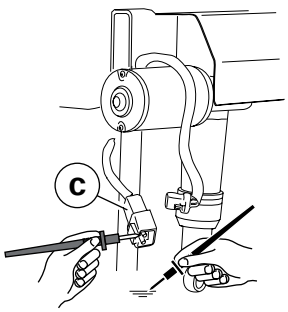
- If more than 1.0 Ohms is measured, replace the right actuator.
- If 0.2–1.0 Ohms is measured, continue.



wc_gr003374

7.12.4 The next two tests will check the control board. First, with the ignition switch turned OFF, check for battery voltage at the wiring harness **(c)**. There should be battery voltage between the orange wire and ground and between the black wire and ground.

- If battery voltage is not measured, the control board has failed; replace it.
- If battery voltage is measured, continue.



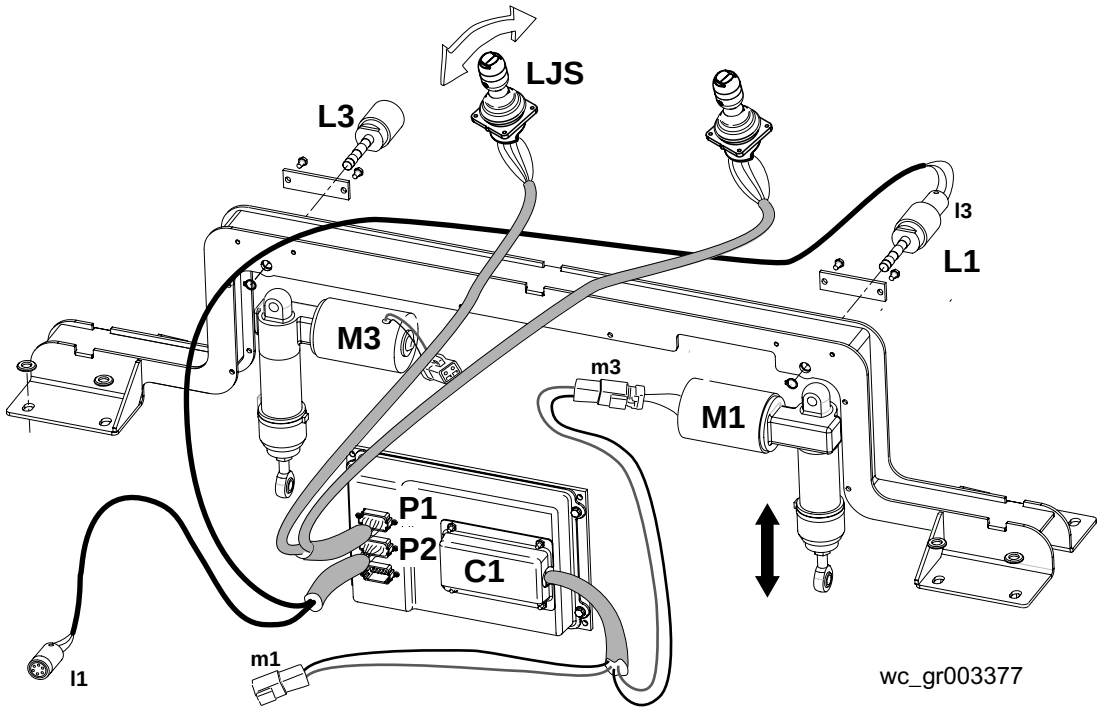
wc_gr003375

7.12.5 Secondly, with the actuator motor still disconnected, connect your multimeter between the orange wire of the wiring harness and ground. Turn the ignition switch ON. Move the right joystick to the full-forward, center, and full-reverse positions. The multimeter should read battery voltage in one of the positions, but read 0 (zero) Volts in the center and opposite position. Perform the same test on the black wire; the readings should be reversed.

- If your readings did not respond accordingly, the control board has failed; replace it.
- If your readings were OK, continue.

7.12.6 With the ignition switch OFF and the actuator motor still disconnected, disconnect the wiring from the left actuator motor **(M3)**,the left load pin **(L3)**, and the right load pin **(L1)**.

7.12.7 Connect the wiring for the left actuator motor to the right actuator motor, and the wiring for the left load pin to the right load pin.



7.12.8 Turn the ignition switch ON. Move the left joystick forward and backward while watching the right actuator for movement. The right actuator should move with the movements from the left joystick.

- If the right actuator does not move, the right actuator has failed; replace it.
- If the right actuator moves, check the function of the right joystick.

7.12.9 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

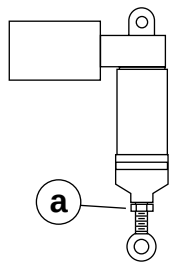
7.13 Error Code 121—Side Actuator Fault

A side actuator fault may be caused by faulty wiring to the actuator motor, a loose actuator jam nut, a faulty actuator motor, or a malfunctioning control board.

7.13.1 Check the condition of the wiring and wire connections at the actuator motor. If necesary, check the continuity of the wiring between the control board and the actuator motor. If the wiring is OK, continue.

7.13.2 Turn the ignition switch ON. Watch for movement of the side actuator when the right joystick is moved to the full-left and full-right positions.

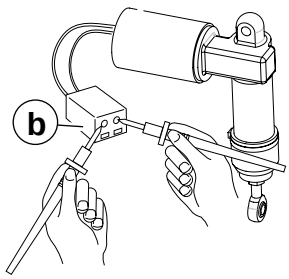
- If there is little or erratic movement, turn the ignition switch OFF. Check that the jam nut **(a)** at the bottom of the actuator cylinder is tight. If the jam nut is loose, the actuator will have erratic or no movement. Apply red Loctite or an equivalent to the jam nut and tighten. See section *Removal and Installation of Electric Steering Actuators*.
- If the jam nut is tight, continue.



wc_gr003373

7.13.3 To test the actuator motor: Turn the ignition switch OFF. Disconnect the wiring harness from the side actuator motor M2. Use a multimeter and check the resistance of the actuator motor's windings. Do so by probing the connector **(b)**. The resistance should be 0.2–1.0 Ohms.

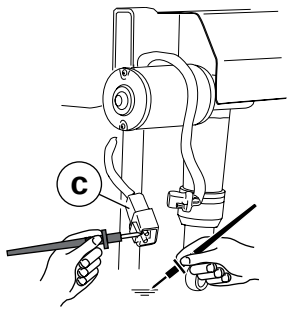
- If more than 1.0 Ohms is measured, replace the right actuator.
- If 0.2–1.0 Ohms is measured, continue.



wc_gr003374

7.13.4 The next two tests will check the control board. First, with the ignition switch turned OFF, check for battery voltage at the wiring harness **(c)**. There should be battery voltage between the orange wire and ground and between the black wire and ground.

- If battery voltage is not measured, check the continuity of the wiring. Repair or replace the wiring as needed.
- If battery voltage is measured, continue.



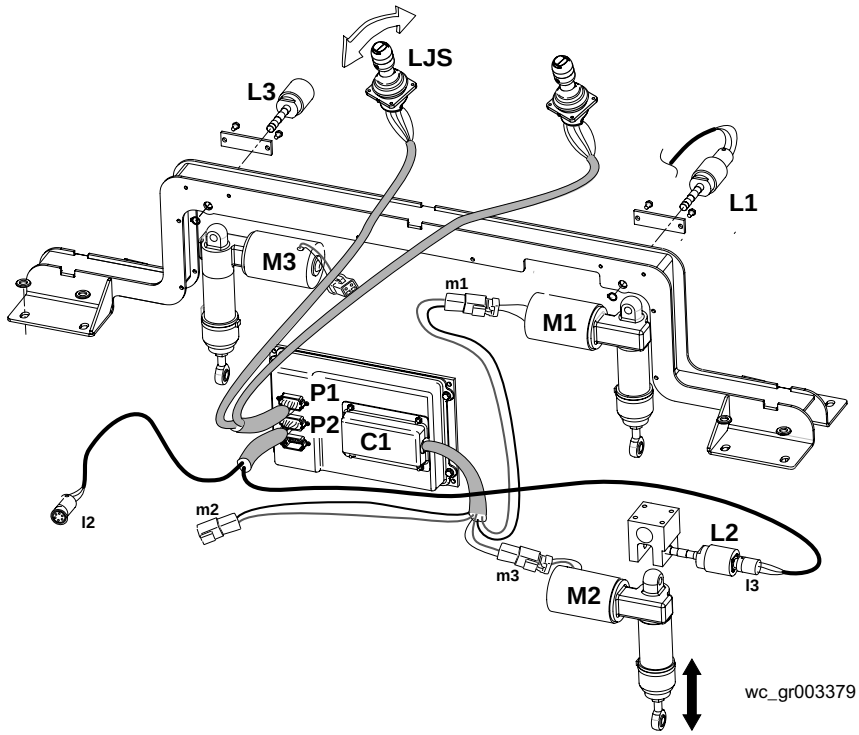
wc_gr003375

7.13.5 Secondly, with the actuator motor still disconnected, connect your multimeter between the orange wire of the wiring harness and ground. Turn the ignition switch ON. Move the right joystick to the full forward, center, and to the full-reverse positions. The multimeter should read battery voltage in one of the positions, but read 0 (zero) Volts in the center and opposite position. Perform the same test on the black wire; the readings should be reversed.

- If your readings did not respond accordingly, the control board has failed; replace it.
- If your readings were OK, continue.

7.13.6 With the ignition switch OFF and the actuator motor still disconnected, disconnect the wiring from the left actuator motor **(M3)**, the left load pin **(L3)**, and the side load pin **(L1)**.

7.13.7 Connect the wiring for the left actuator motor to the side actuator motor, and the wiring for the left load pin to the side load pin.



7.13.8 Turn the ignition switch ON. Move the left joystick forward and backward while watching the side actuator for movement. The side actuator should move with the movements from the left joystick.

- If the side actuator does not move, the side actuator has failed; replace it.
- If the side actuator moves, check the function of the right joystick.

7.13.9 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn ignition switch ON and test the function of all three circuits: right, left, and side.

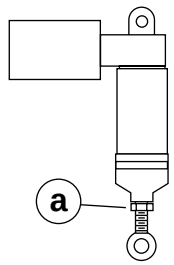
7.14 Error Code 131—Left Actuator Fault

A left actuator fault may be caused by faulty wiring to the actuator motor, a loose actuator jam nut, a faulty actuator motor, or a malfunctioning control board.

7.14.1 Check the condition of the wiring and wire connections at the actuator motor. If necesary, check the continuity of the wiring between the control board and the actuator motor. If the wiring is OK, continue.

7.14.2 Turn the ignition switch ON. Move the left joystick back and forth from its full-forward to its full-reverse positions and watch for movement of the left actuator.

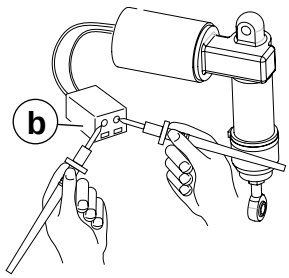
- If there is little or erratic movement, turn the ignition switch OFF. Check that the jam nut **(a)** at the bottom of the actuator cylinder is tight. If the jam nut is loose, the actuator will have erratic or no movement. Apply red Loctite or an equivalent to the jam nut and tighten it. See section *Removal and Installation of Electric Steering Actuators*.
- If the jam nut is tight, continue.



wc_gr003373

7.14.3 To test the actuator motor: Turn the ignition switch OFF. Disconnect the wiring harness from the left actuator motor M3. Use a multimeter and check the resistance of the actuator motor's windings. Do so by probing the connector **(b)**. The resistance should be 0.2–1.0 Ohms.

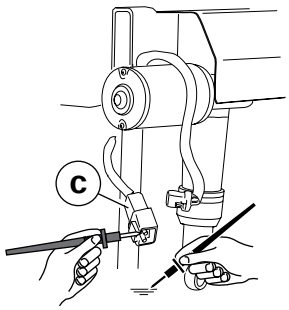
- If more than 1.0 Ohms is measured, replace the right actuator.
- If 0.2–1.0 Ohms is measured, continue.



wc_gr003374

7.14.4 The next two tests will check the control board. First, with the ignition switch turned OFF, check for battery voltage at the wiring harness **(c)**. There should be battery voltage between the orange wire and ground and between the black wire and ground.

- If battery voltage is not measured, the control board has failed; replace it.
- If battery voltage is measured, continue.



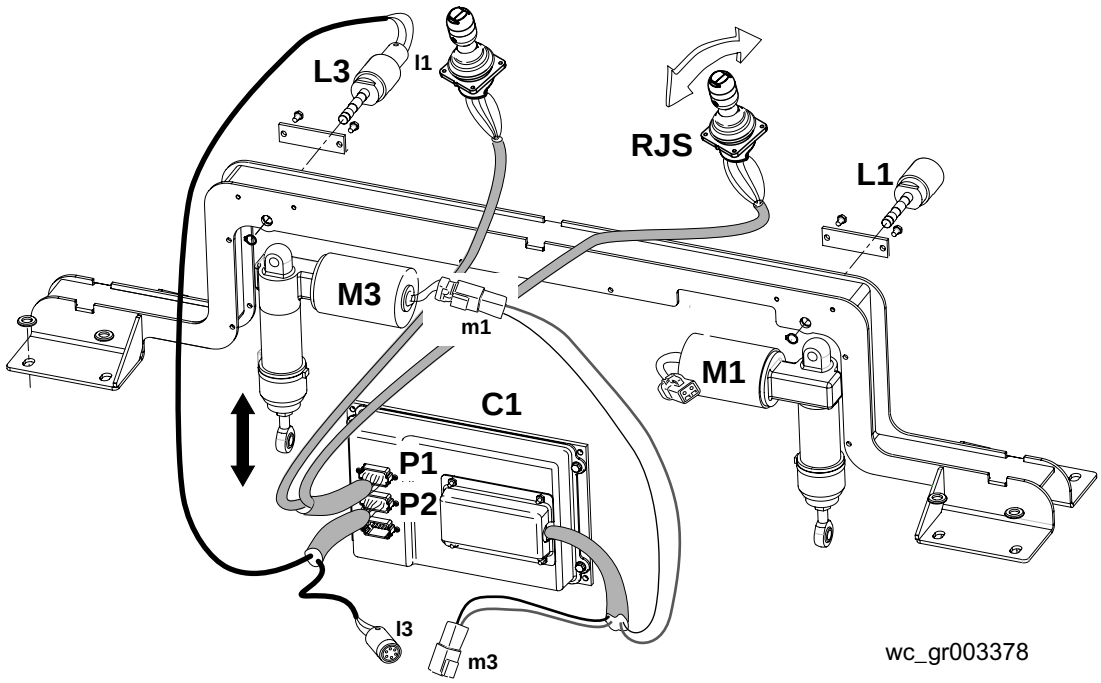
wc_gr003375

7.14.5 Secondly, with the actuator motor still disconnected, connect your multimeter between the orange wire of the wiring harness and ground. Turn the ignition switch ON. Move the left joystick to the full-forward, center, and full-reverse positions. The multimeter should read battery voltage in one of the positions, but read 0 (zero) Volts in the center and opposite position. Perform the same test on the black wire; the readings should be reversed.

- If your readings did not respond accordingly, the control board has failed; replace it.
- If your readings were OK, continue.

7.14.6 With the ignition switch OFF and the actuator motor still disconnected, disconnect the wiring from the right actuator motor **(M1)**, the right load pin **(L1)**, and the left load pin **(L3)**.

7.14.7 Connect the wiring for the right actuator motor to the left actuator motor, and the wiring for the right load pin to the left load pin.



7.14.8 Turn the ignition switch ON. Move the right joystick forward and backward while watching the left actuator for movement. The left actuator should move with the movements from the right joystick.

- If the left actuator does not move, the left actuator has failed; replace it.
- If the left actuator moves, check the function of the left joystick.

7.14.9 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

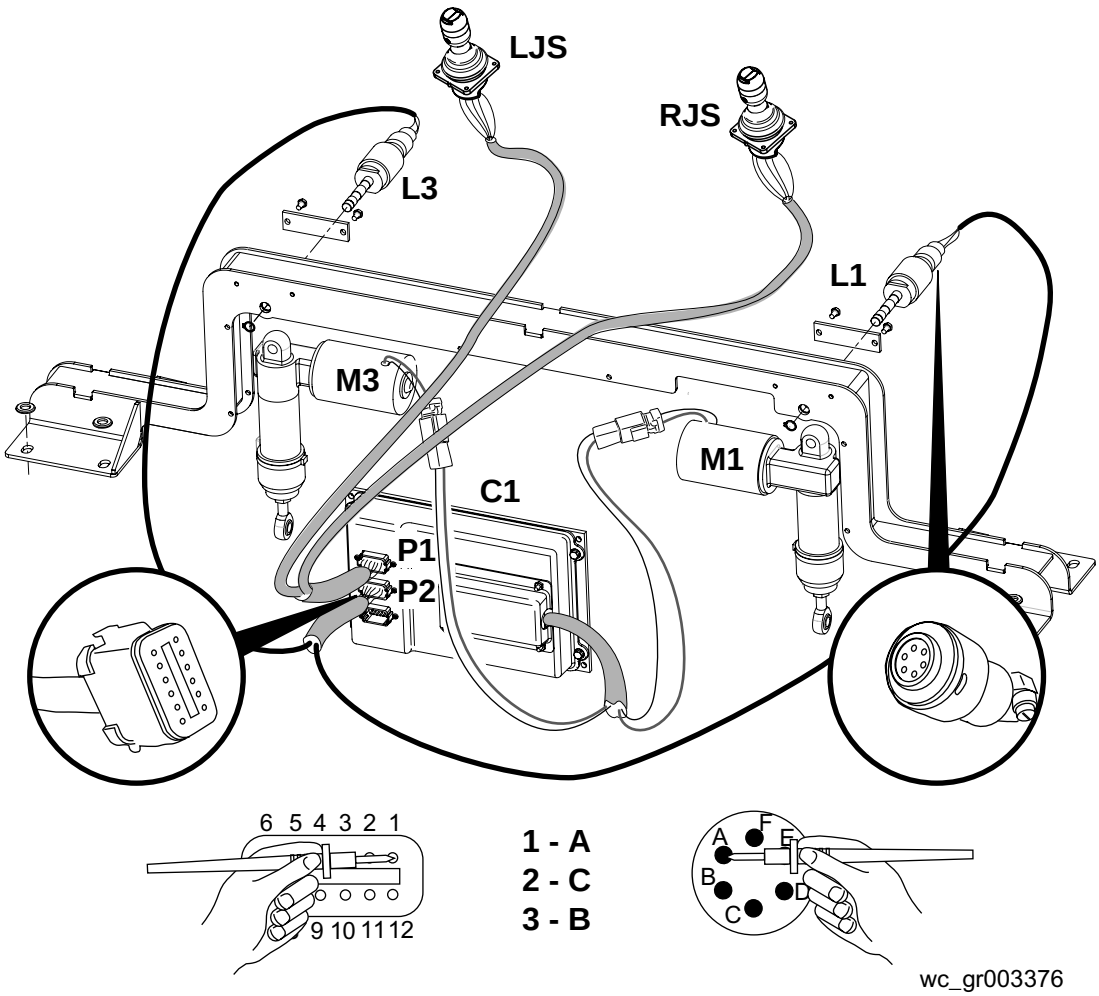
7.15 Error Code 211—Right Load Pin Open Circuit

See Graphic: wc_gr003376

7.15.1 Check the wire connections at the load pin **(L1)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

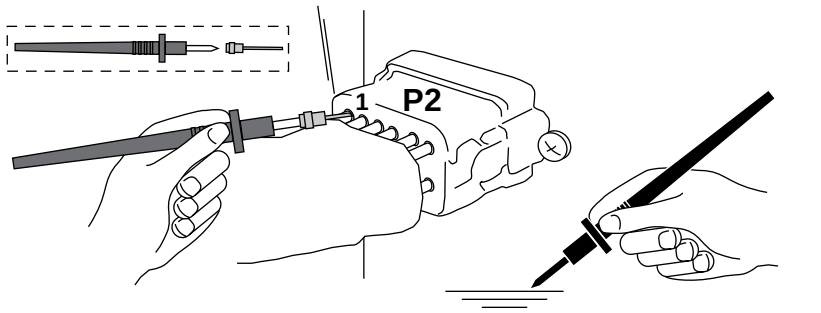
7.15.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L1 connector from the load pin. Then, check the continuity of the wiring between pin 1 of the P2 connector and terminal A of the L1 connector. Also check pin 2 to terminal C, and pin 3 to terminal B.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.15.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #1 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

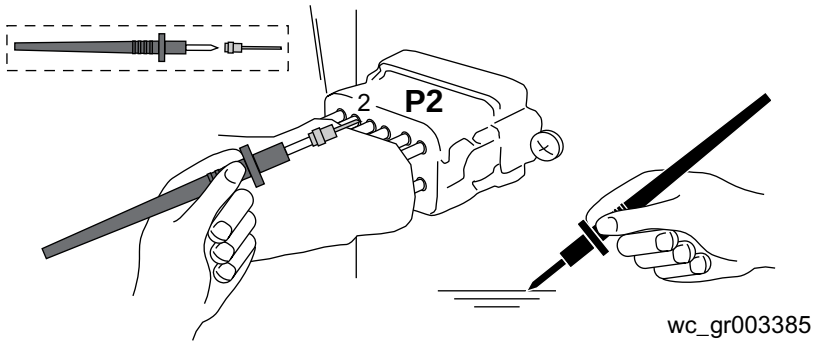
- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



wc_gr003384

7.15.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #2 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



wc_gr003385

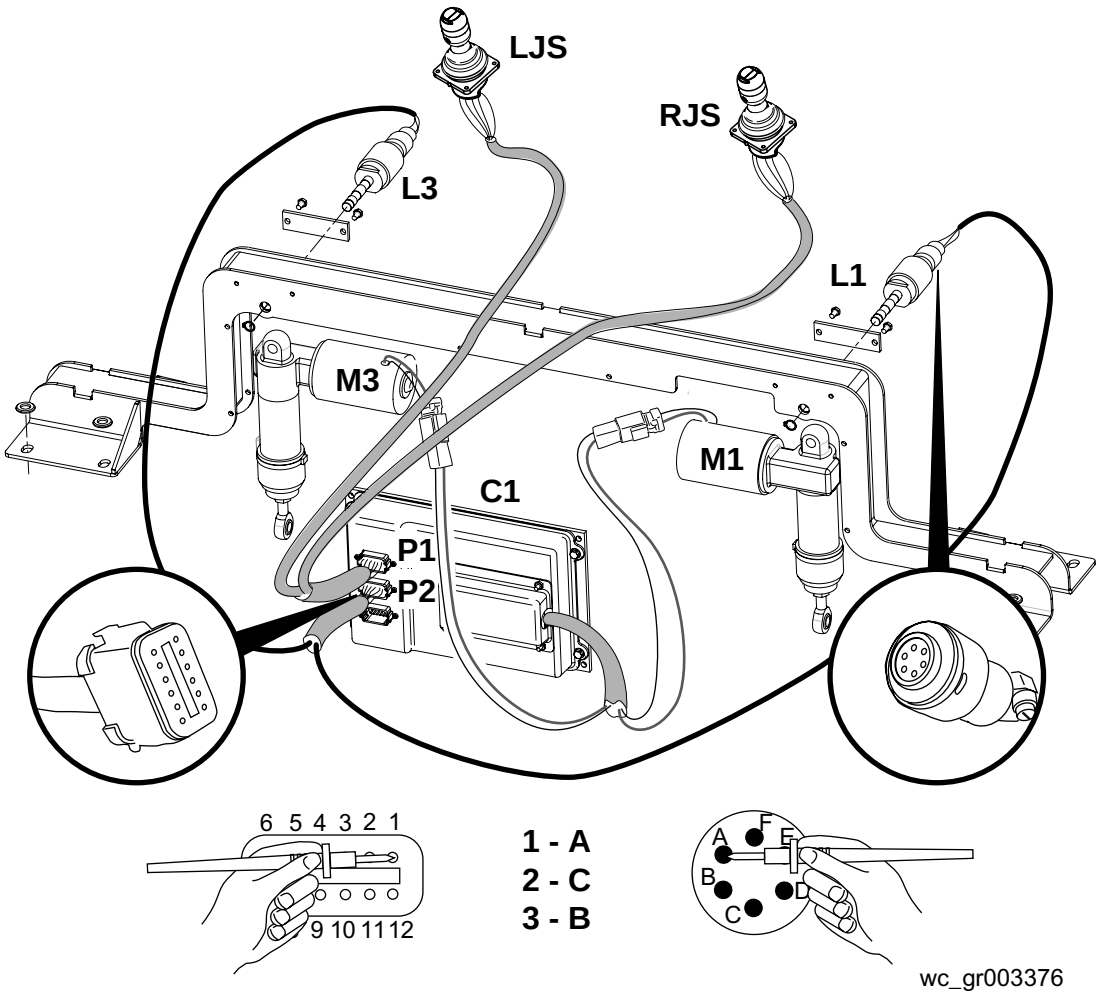
7.15.5 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.16 Error Code 212—Right Load Pin Short Circuit

7.16.1 Check the wire connections at the load pin **(L1)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

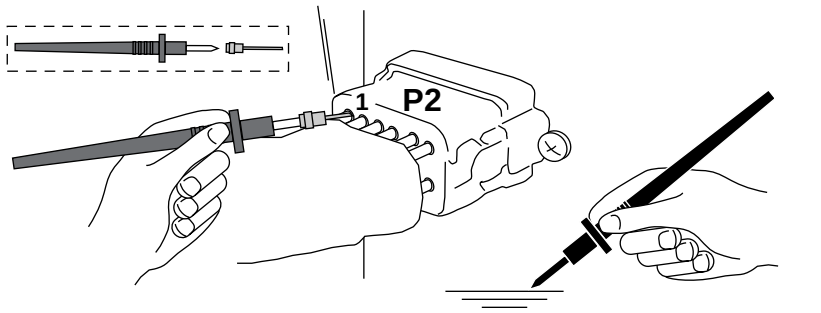
7.16.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L1 connector from the load pin. Then, check the continuity of the wiring between pin 1 of the P2 connector and terminal A of the L1 connector. Also check pin 2 to terminal C, and pin 3 to terminal B.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.16.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #1 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

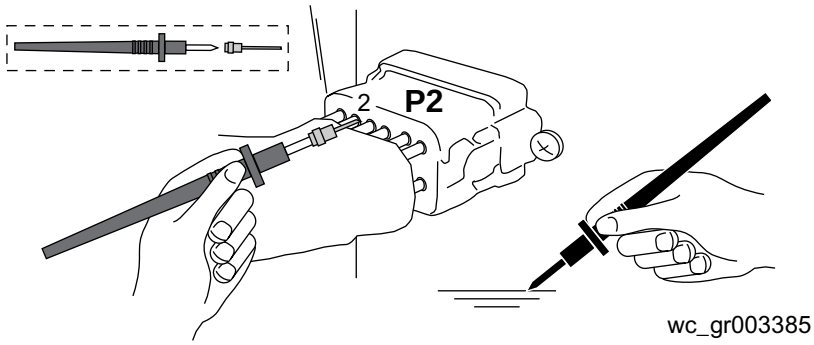
- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



wc_gr003384

7.16.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #2 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

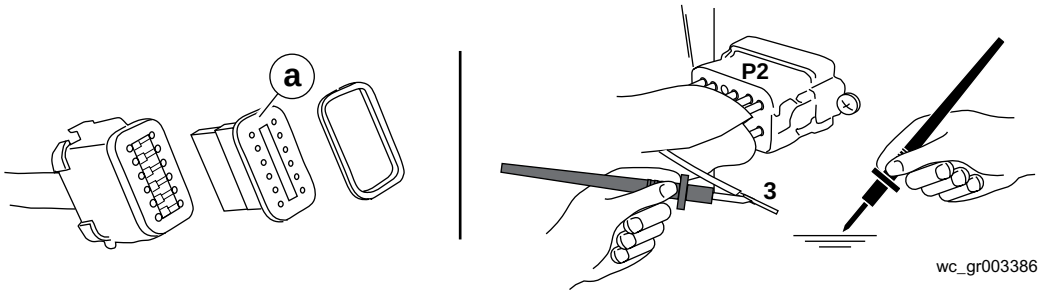
- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



wc_gr003385

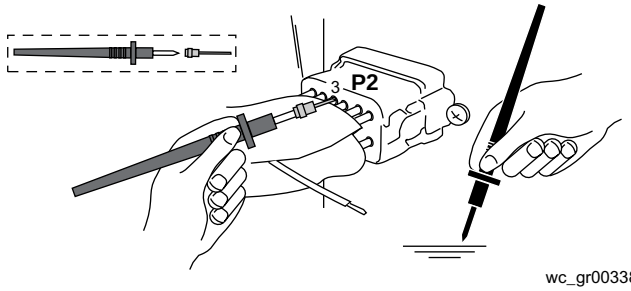
7.16.5 Check if voltage is being leaked through the load pin's ground wire. To do so, disconnect the wiring harness at P2. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the wire to terminal #3. Do not allow the wire to contact any metal surface. Reinstall the orange locking plug and reconnect the connector to the control board at P2. Turn the ignition ON and check for voltage between the wire and ground. There should be no voltage.

- If voltage is measured, the load pin has failed; replace it.
- If no voltage is measured, continue.



7.16.6 With the wire to terminal #3 still disconnected, check the control board for a voltage leak. Probe the connector at pin #3 with the red lead and ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect terminal wire 3 to the connector.



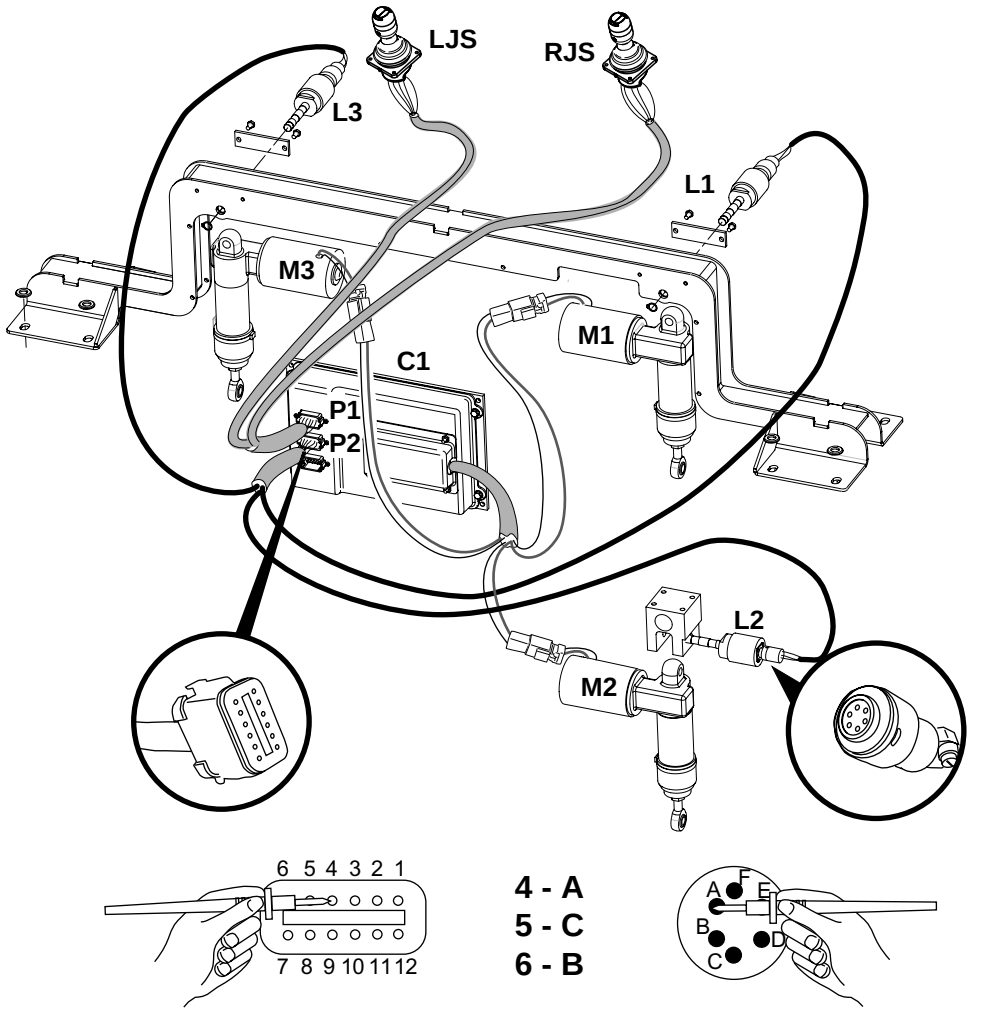
7.16.7 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.17 Error Code 221—Side Load Pin Open Circuit

7.17.1 Check the wire connections at the load pin **(L2)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

7.17.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L2 connector from the load pin. Then, check the continuity of the wiring between pin 4 of the P2 connector and terminal A of the L2 connector. Also check pin 5 to terminal C, and pin 6 to terminal B.

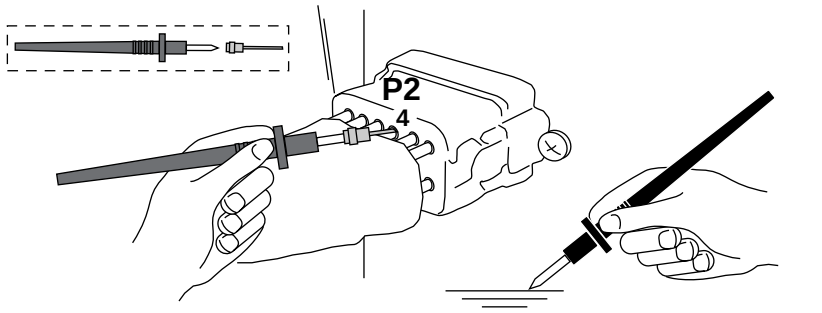
- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



wc_gr003388

7.17.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #4 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

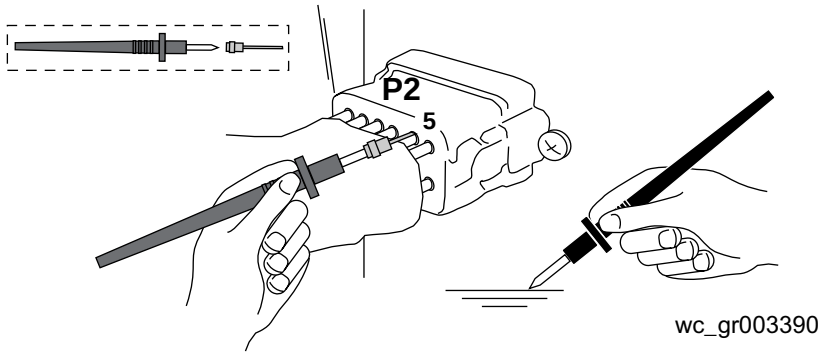
- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



wc_gr003389

7.17.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #5 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



wc_gr003390

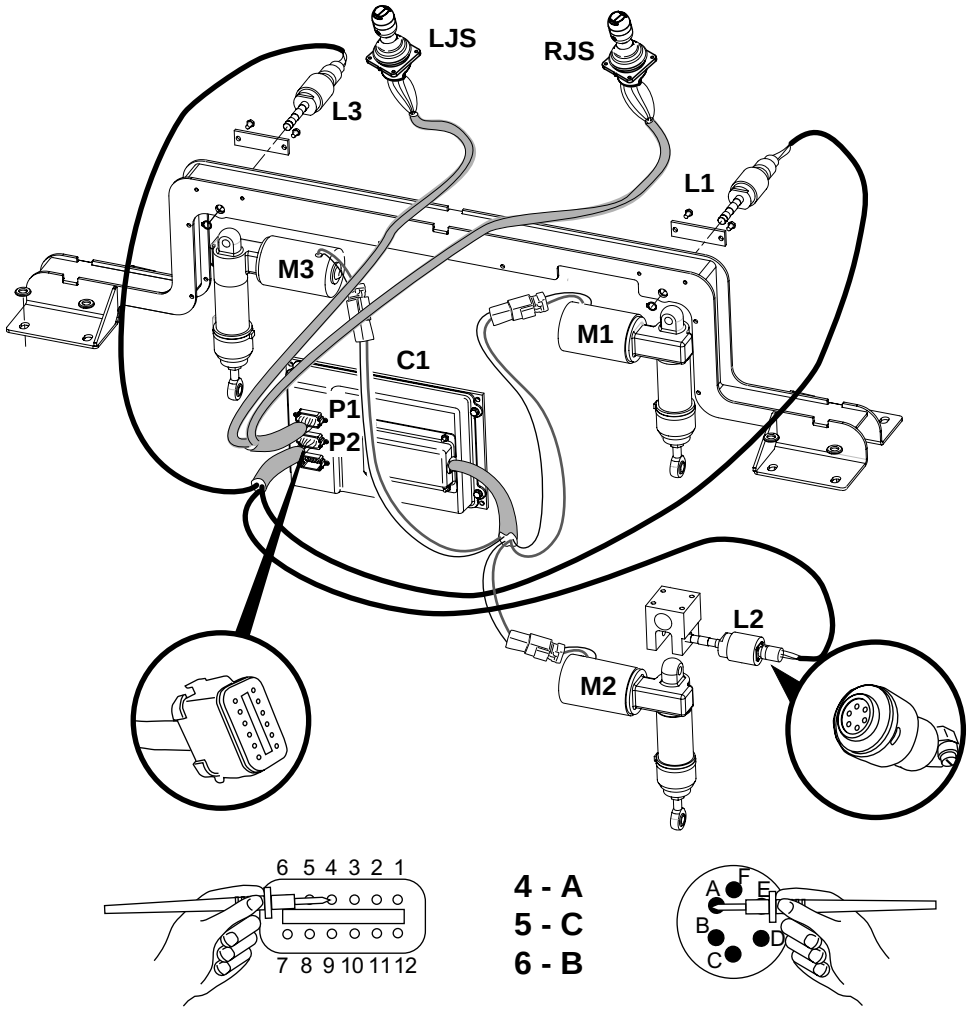
7.17.5 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.18 Error Code 222—Side Load Pin Short Circuit

7.18.1 Check the wire connections at the load pin **(L2)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

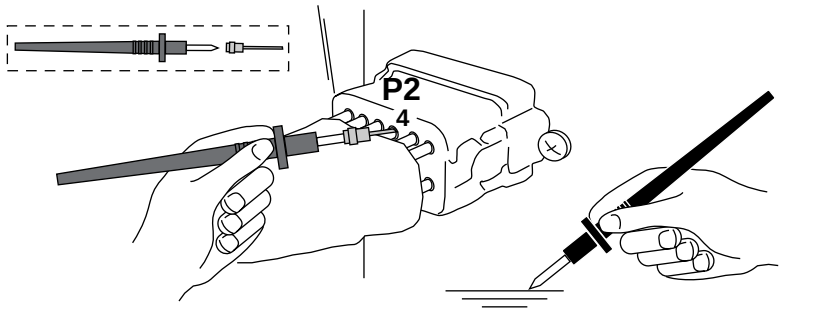
7.18.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L2 connector from the load pin. Then, check the continuity of the wiring between pin 4 of the P2 connector and terminal A of the L2 connector. Also check pin 5 to terminal C, and pin 6 to terminal B.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.18.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #4 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

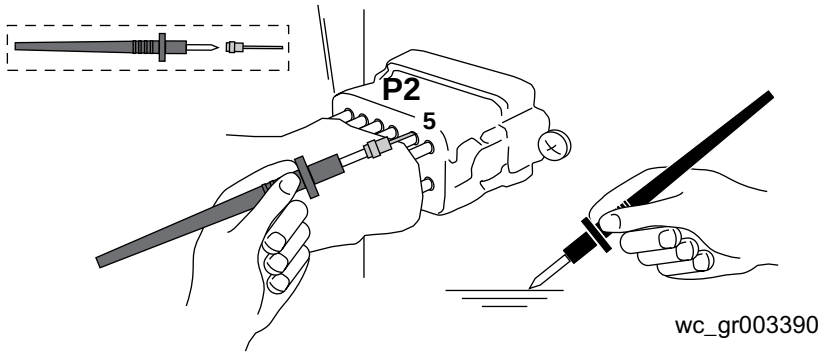
- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



wc_gr003389

7.18.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #5 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

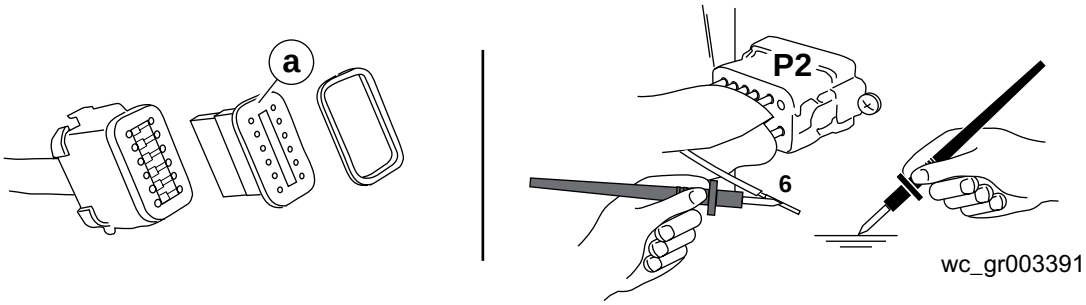
- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



wc_gr003390

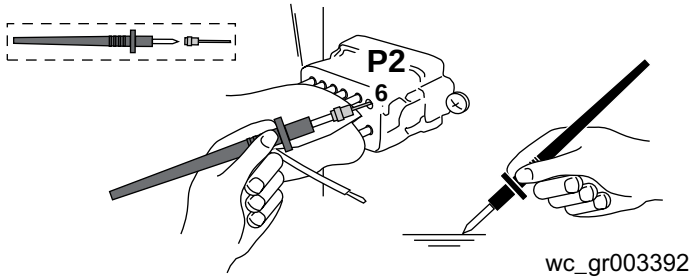
7.18.5 Check if voltage is being leaked through the load pin's ground wire. To do so, disconnect the wiring harness at P2. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the wire to terminal #6. Reinstall the orange locking plug and reconnect the connector to the control board at P2. Turn the ignition ON and check for voltage between the wire and ground. There should be no voltage.

- If voltage is measured, the load pin has failed; replace it.
- If no voltage is measured, continue.



7.18.6 With the wire to terminal #6 still disconnected, check the control board for a voltage leak. Probe the connector at pin 6 with the red lead and ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect the wire to terminal #6 to the connector.



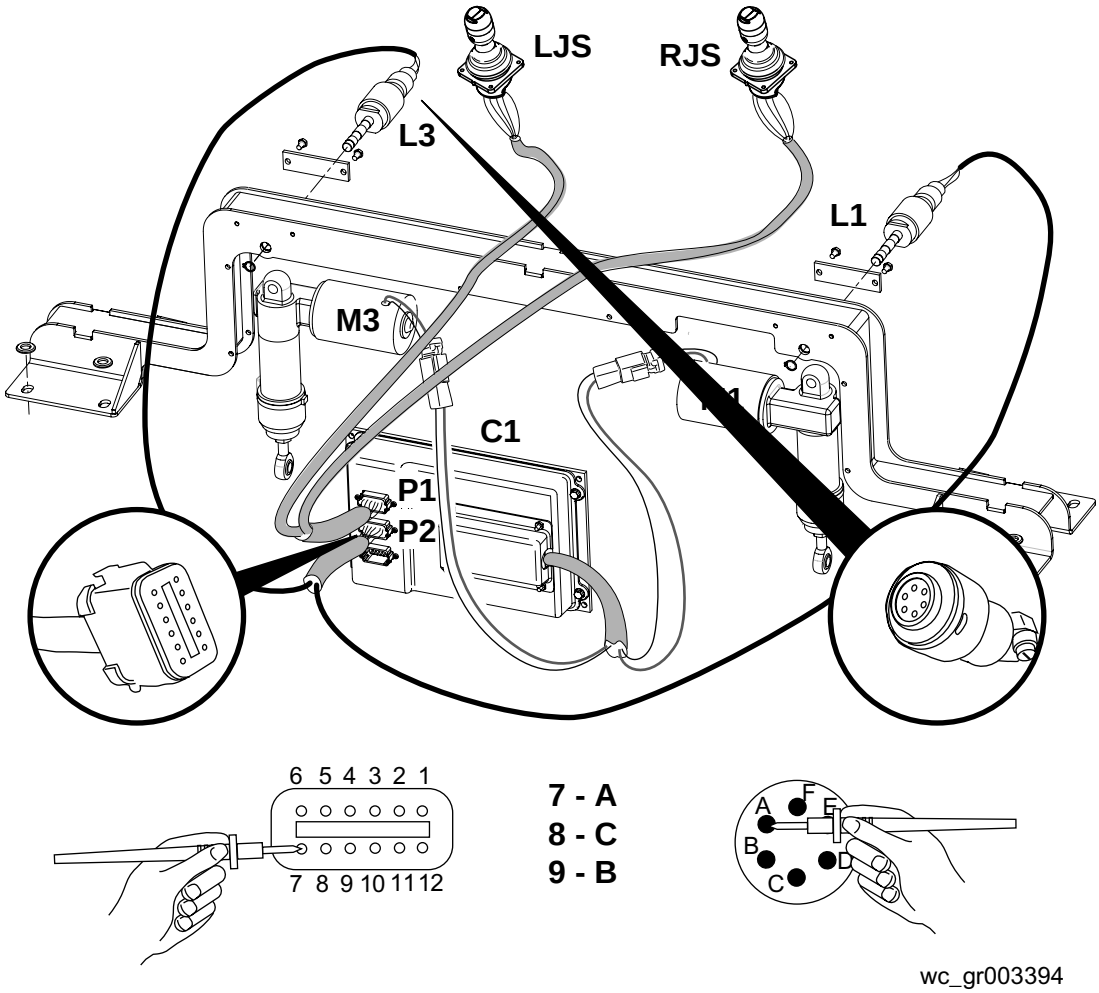
7.18.7 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.19 Error Code 231—Left Load Pin Open Circuit

7.19.1 Check the wire connections at the load pin **(L3)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

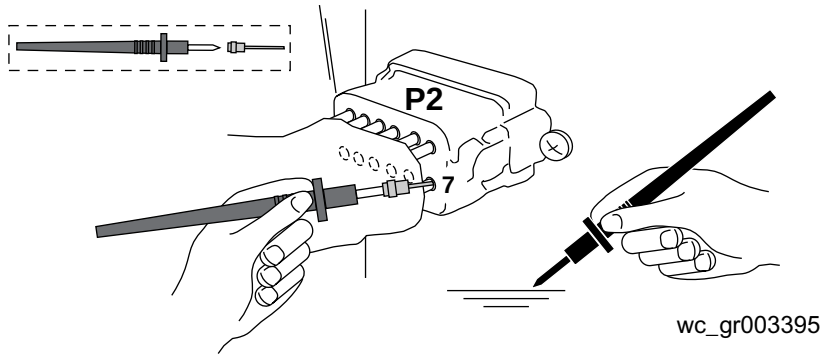
7.19.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L3 connector from the load pin. Then, check the continuity of the wiring between pin 7 of the P2 connector and terminal A of the L3 connector. Also check pin 8 to terminal C, and pin 9 to terminal B.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



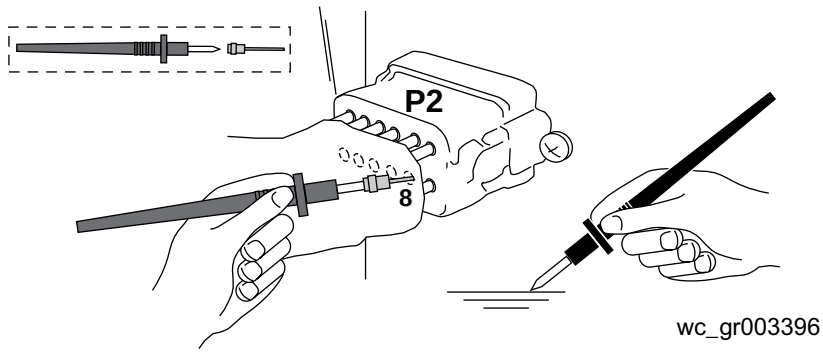
7.19.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #7 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



7.19.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #8 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



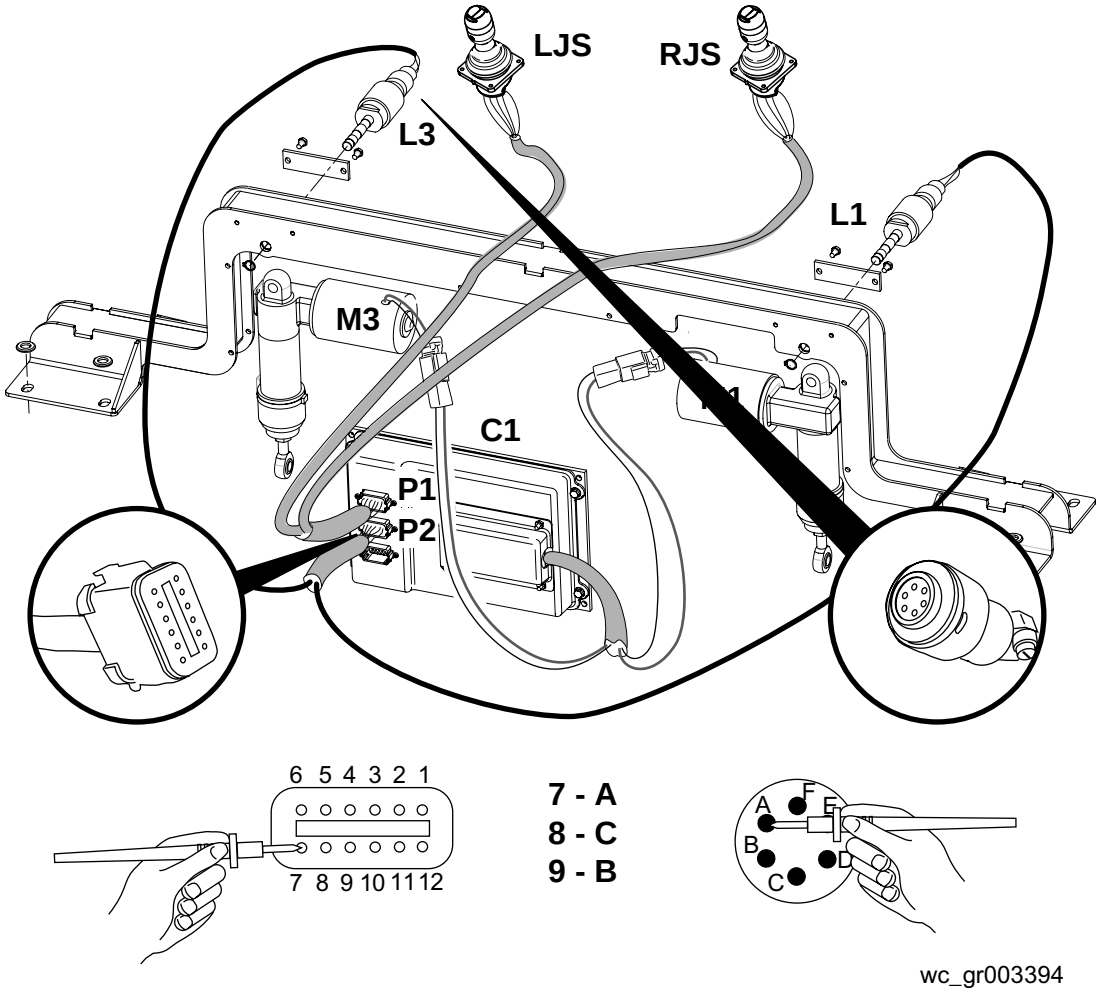
7.19.5 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.20 Error Code 232—Left Load Pin Short Circuit

7.20.1 Check the wire connections at the load pin **(L3)** and at the control board connector **(P2)**. Reconnect the wiring if needed. If the fault condition remains, continue.

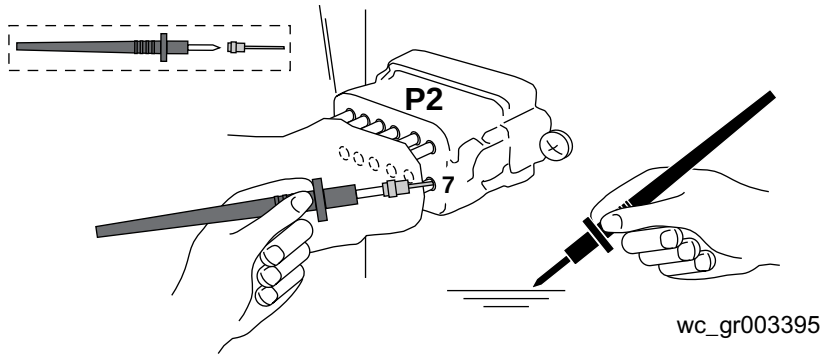
7.20.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P2 connector from the control board and the L3 connector from the load pin. Then, check the continuity of the wiring between pin 7 of the P2 connector and terminal A of the L3 connector. Also check pin 8 to terminal C, and pin 9 to terminal B.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



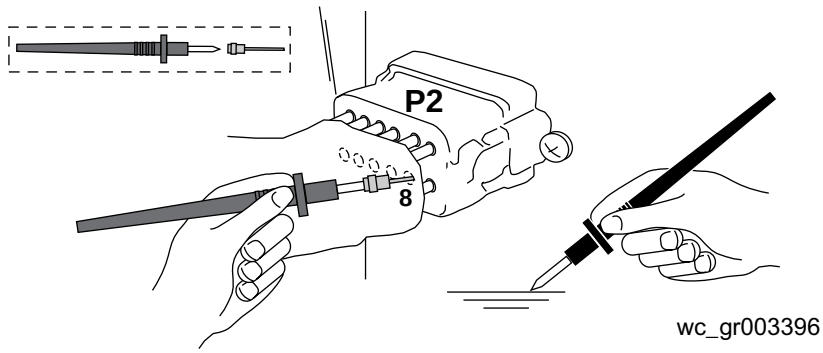
7.20.3 Check if battery voltage is being sent to the load pin from the control board. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #7 terminal of the P2 connector with the red lead of the multimeter. The multimeter should read battery voltage (approximately 12VDC).

- If no voltage is present, the control board has failed; replace it.
- If battery voltage is present, continue.



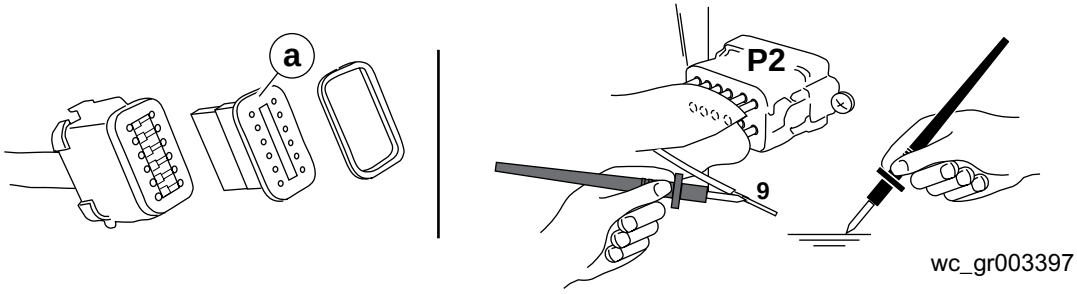
7.20.4 Check if feedback voltage is being sent from the load pin to the control board. To do so, leave the black lead connected to the common ground, back probe the #8 terminal of the P2 connector with the red lead, and turn the ignition switch ON. With the right joystick in the center (neutral) position, the multimeter should read 2.5±0.2 VDC.

- If 2.5±0.2 VDC is present, the system should be functioning. Any problems are internal to the software of the control board. Consult Wacker Service.
- If no voltage is present, the right load pin has failed; replace it.



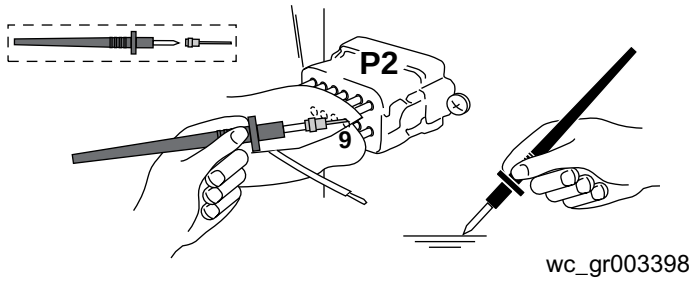
7.20.5 Check if voltage is being leaked through the load pin's ground wire. To do so, disconnect the wiring harness at P2. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the wire to terminal #9. Do not allow the wire to contact any metal surface. Reinstall the orange locking plug and reconnect the connector to the control board at P2. Turn the ignition ON and check for voltage between the wire and ground. There should be no voltage.

- If voltage is measured, the load pin has failed; replace it.
- If no voltage is measured, continue.



7.20.6 With the wire to terminal #9 still disconnected, check the control board for a voltage leak. Probe the connector at pin 9 with the red lead and ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect the wire to terminal #9 of the connector.



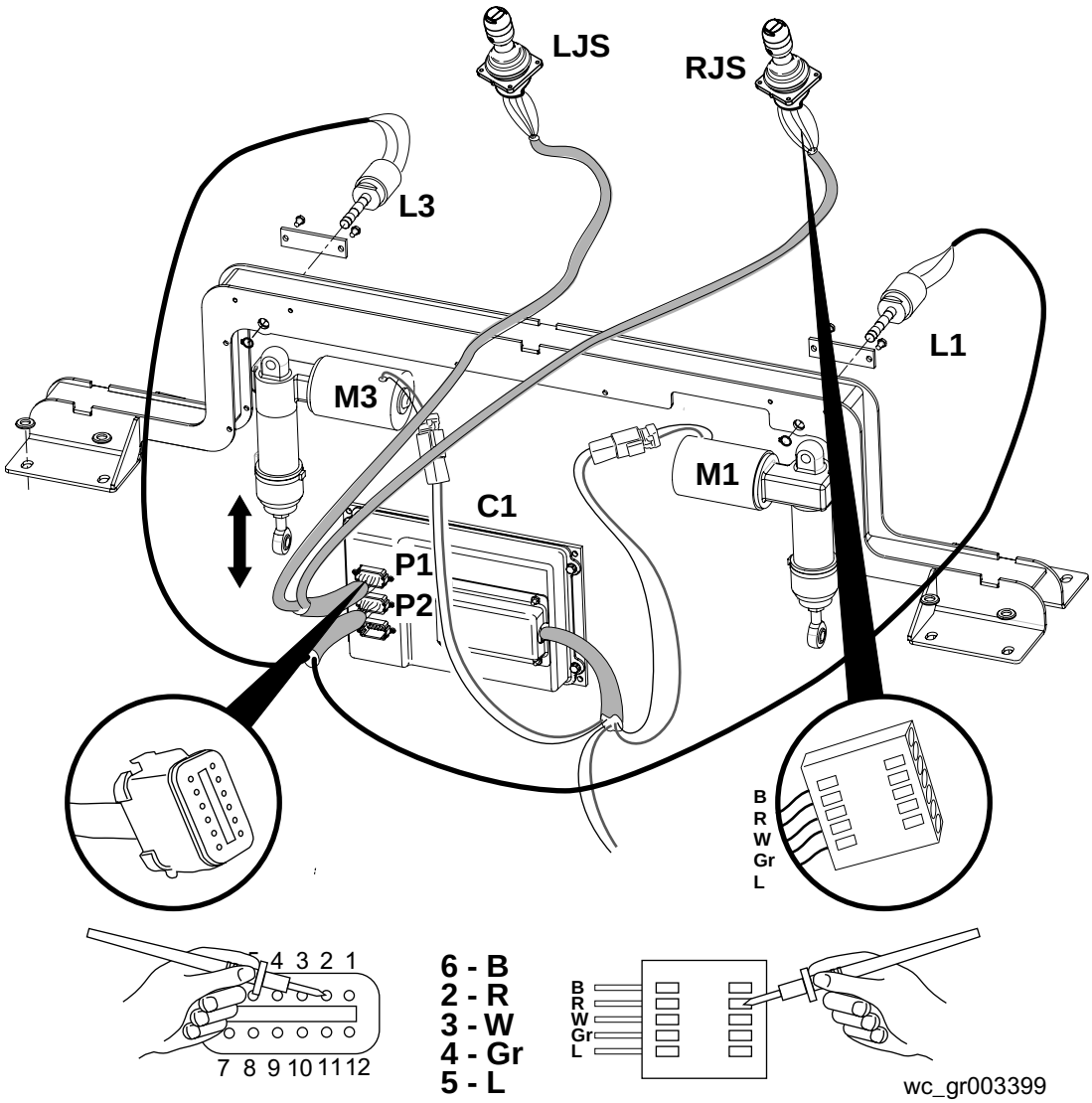
7.20.7 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.21 Error Code 311—Right Joystick Open Circuit

7.21.1 Check the wire connections at the joystick and at the control board connector **(P1)**. Reconnect the wiring if needed. If the fault condition remains, continue.

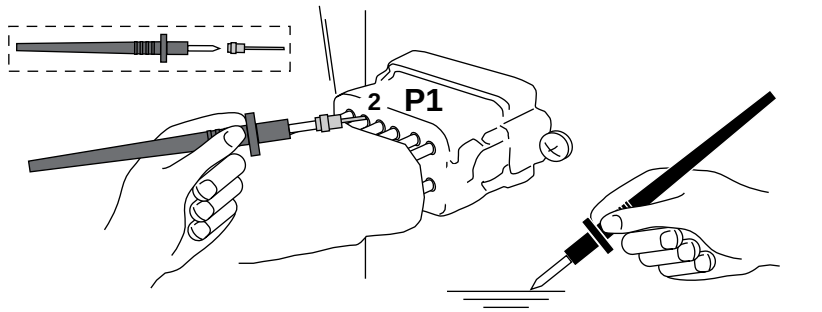
7.21.2 Check the continuity of the wiring between the control board and the joystick. To do so, disconnect the P1 connector from the control board and the wiring connector from the joystick. Then, check the continuity of the wiring between pins 2 through 6 of the P1 connector and the red (R), white (W), gray (Gr), blue (L), and black (B) wires at the joystick connector. See section *Removal and Installation of Joysticks for* joystick disassembly.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.21.3 Check for voltage at the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #2 terminal of the P1 connector with the red lead of the multimeter.The multimeter should read 5.0±0.2 Volts.

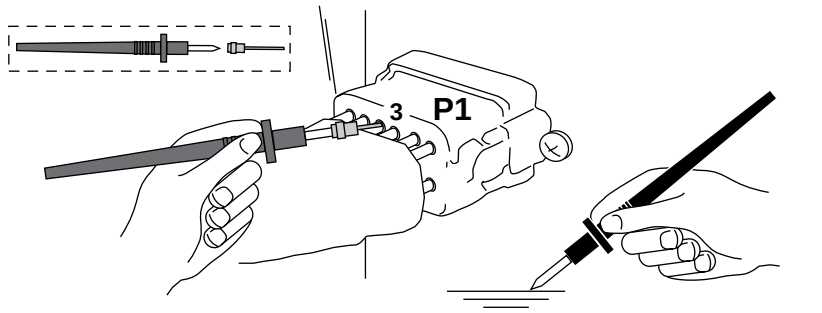
- If no voltage is measured, the control board has failed; replace it.
- If voltage is measured,continue.



wc_gr003400

7.21.4 Check for feedback voltage (forward and reverse operation) from the joystick at the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #3 terminal of the P1 connector. With the right joystick in the centered position, 2.5±0.2 Volts should be measured.

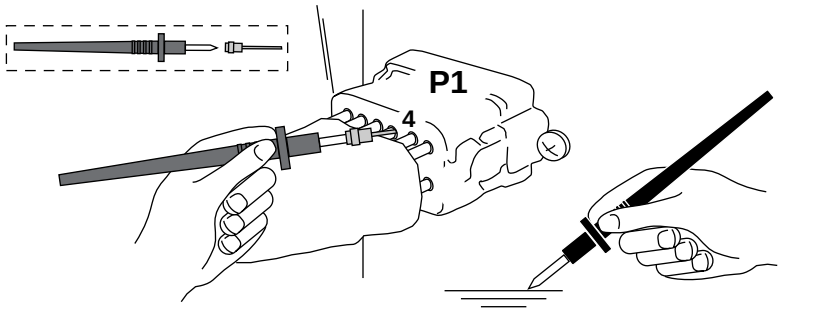
- If no voltage is measured, the right joystick has failed; replace it.
- If proper voltage is measured, continue.



wc_gr003401

7.21.5 Check for feedback voltage (side-to-side operation) from the joystick at the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #4 terminal of the P1 connector. With the right joystick in the centered position, 2.5±0.2 Volts should be measured.

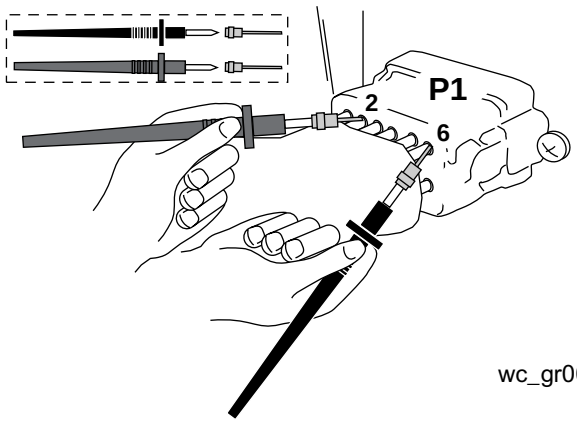
- If no voltage is measured, the right joystick has failed; replace it.
- If proper voltage is measured, continue.



wc_gr003402

7.21.6 Check the function of the control board ground pin 6. To do so, probe terminal #2 of the P1 connector with the red lead of your multimeter and terminal #6 with the black lead. You should measure 5.0±0.2 Volts.

- If the proper voltage is not measured, the control board has failed; replace it.
- If the proper voltage is measured, the system should be functioning.



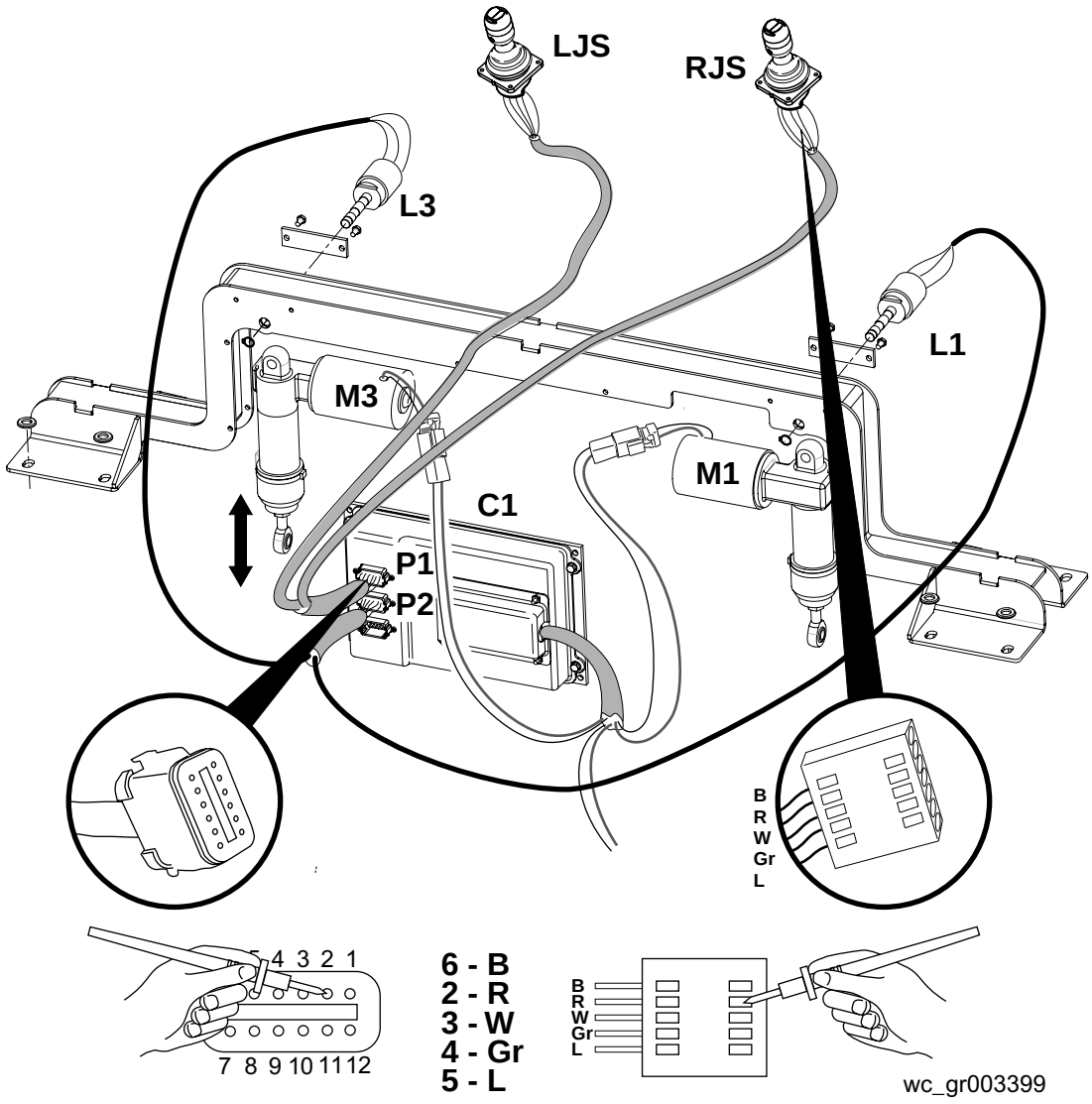
wc_gr003403

7.22 Error Code 312—Right Joystick Short Circuit

7.22.1 Check the wire connections at the joystick and at the control board connector **(P1)**. Reconnect the wiring if needed. If the fault condition remains, continue.

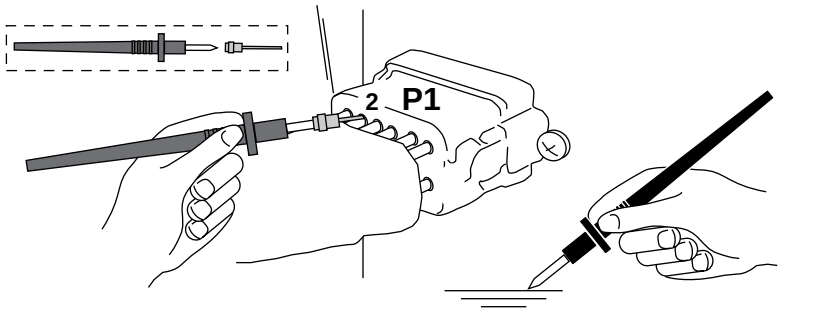
7.22.2 Check the continuity of the wiring between the control board and the load pin. To do so, disconnect the P1 connector from the control board and the wiring connector from the joystick. Then, check the continuity of the wiring between pins 2 through 6 of the P1 connector and the red (R), white (W), gray (Gr), blue (L), and black (B) wires at the joystick connector. See section *Removal and Installation of Joysticks* for joystick disassembly.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.22.3 Check for voltage at terminal #2 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #2 terminal of the P1 connector with the red lead of the multimeter. With the right joystick in the centered position, approximately 5.0 Volts should be measured.

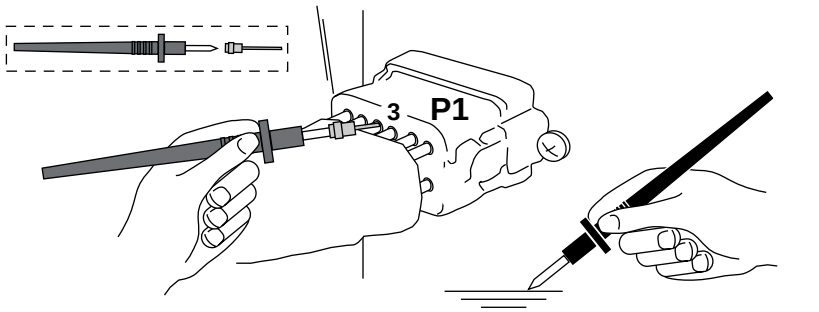
- If no voltage is measured, the control board has failed; replace it.
- If the proper voltage is measured, continue.



wc_gr003400

7.22.4 Check the feedback voltage at terminal #3 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #3 terminal of the P1 connector with the red lead. With the right joystick in the centered position, approximately 2.5 Volts should be measured.

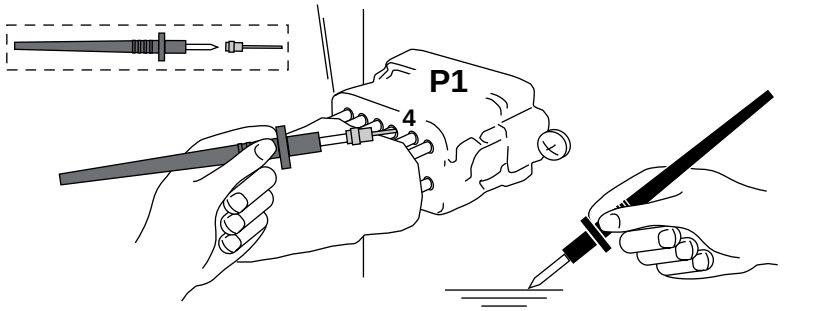
- If no voltage is measured, the right joystick has failed; replace it.
- If the proper voltage is measured, continue.



wc_gr003401

7.22.5 Check the feedback voltage at terminal #4 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #4 terminal of the P1 connector with the red lead. With the right joystick in the centered position, approximately 2.5V should be measured.

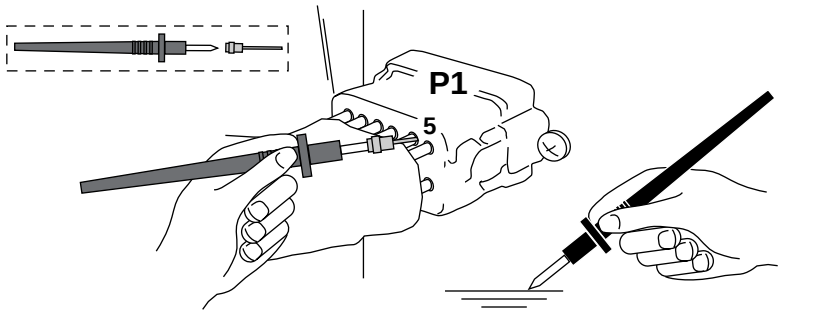
- If more than 2.8V is measured, the right joystick has failed; replace it.
- If the proper voltage is measured, continue.



wc_gr003402

7.22.6 Check the feedback voltage at terminal #5 of the control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #5 terminal of the P1 connector with the red lead. With the right joystick in the centered position, approximately 2.5V should be measured.

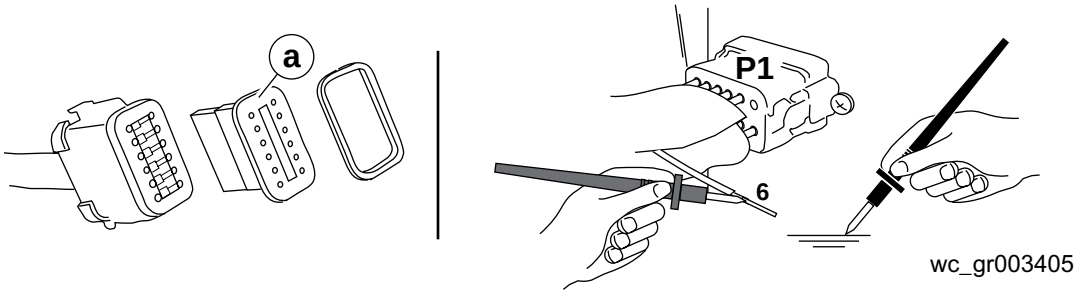
- If the proper voltage is measured, the system should be functioning.
- If the proper voltage is not measured, continue.



wc_gr003404

7.22.7 Check the joystick ground wire. To do so, disconnect the wiring harness at P1. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the black wire from terminal #6**.** Isolate the black wire from all metal surfaces. Reinstall the orange locking plug and reconnect the connector to the control board at P1. Turn the ignition ON and check for voltage between the black wire and ground. There should be no voltage.

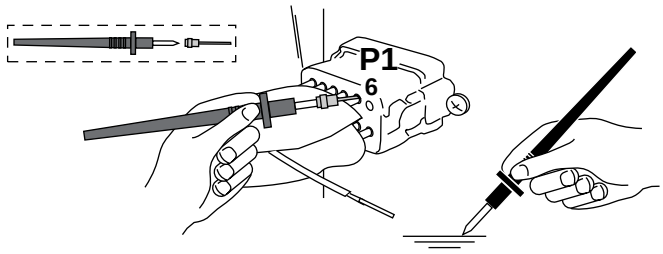
- If voltage is measured, the joystick has failed; replace it.
- If no voltage is measured, continue.



wc_gr003405

7.22.8 With the black wire still disconnected, check the control board for a voltage leak. Probe the #6 terminal of the P1 connector with the red lead, and probe a common ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect the wire to terminal #6 of the connector.



wc_gr003406

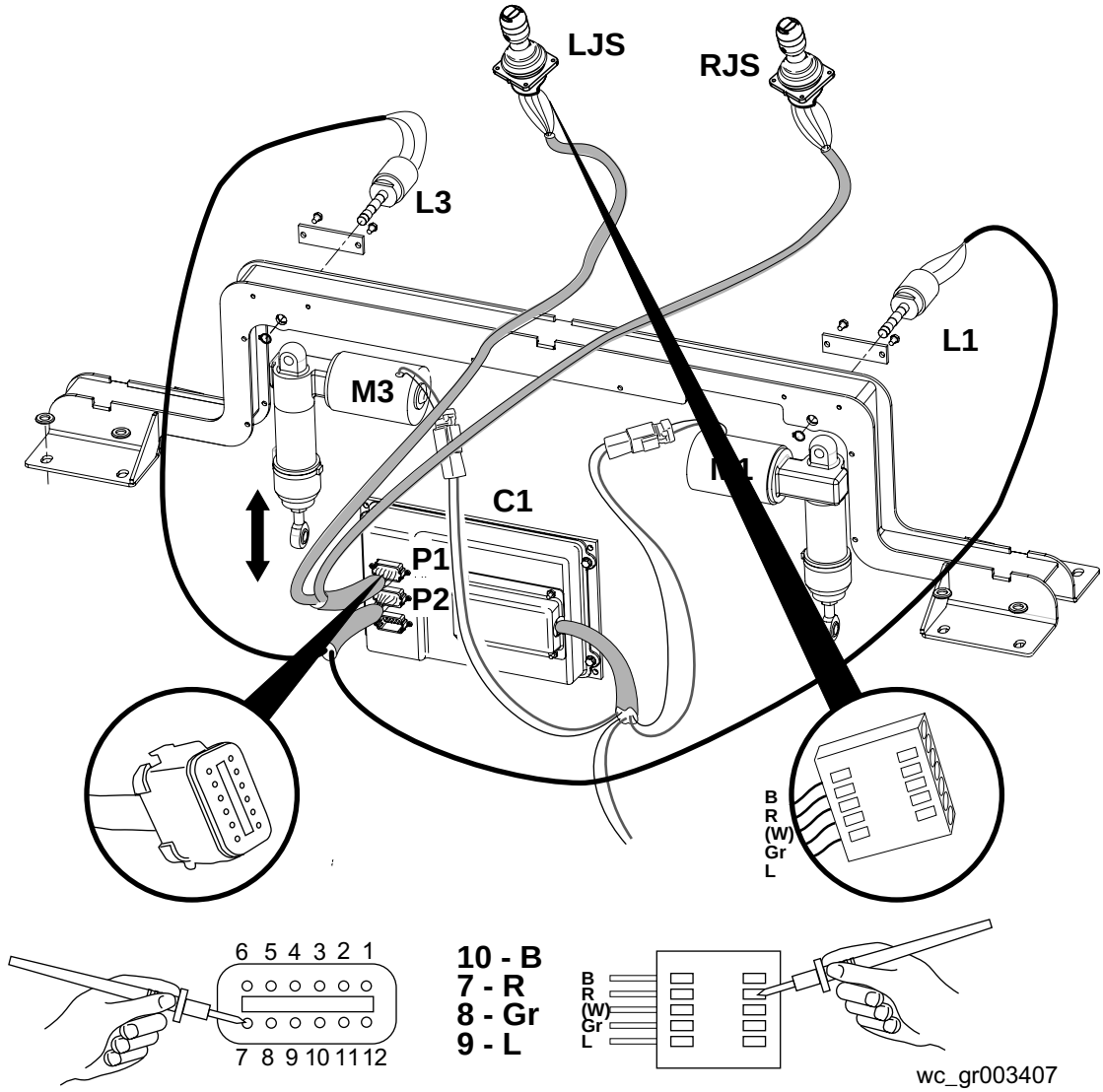
7.22.9 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.23 Error Code 321—Left Joystick Open Circuit

7.23.1 Check the wire connections at the joystick and at the control board connector **(P1)**. Reconnect the wiring if needed. If the fault condition remains, continue.

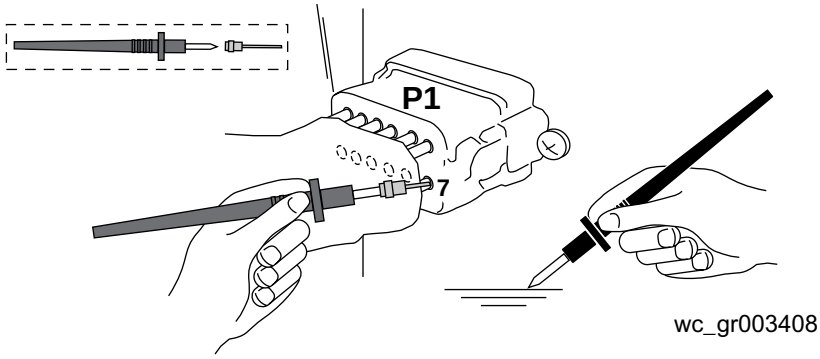
7.23.2 Check the continuity of the wiring between the control board and the joystick. To do so, disconnect the P1 connector from the control board and the wiring connector from the joystick. Then, check the continuity of the wiring between pins 7 through 10 of the P1 connector and the red (R), gray (Gr), blue (L), and black (B) wires at the joystick connector. See section *Removal and Installation of Joysticks* for joystick disassembly.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.23.3 Check for voltage at terminal #7 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #7 terminal of the P1 connector with the red lead of the multimeter. With the left joystick in the centered position, the multimeter should read approximately 5 Volts.

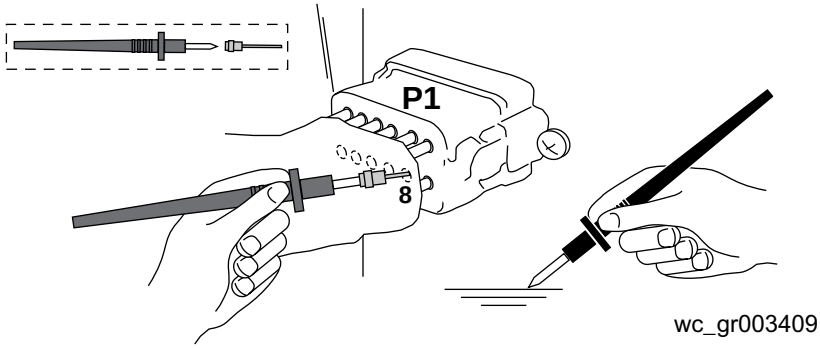
- If no voltage is measured, the control board has failed; replace it.
- If voltage is measured,continue.



wc_gr003408

7.23.4 Check for feedback voltage at terminal #8 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #8 terminal of the P1 connector with the red lead. With the left joystick in the centered position, approximately 2.5 Volts should be measured.

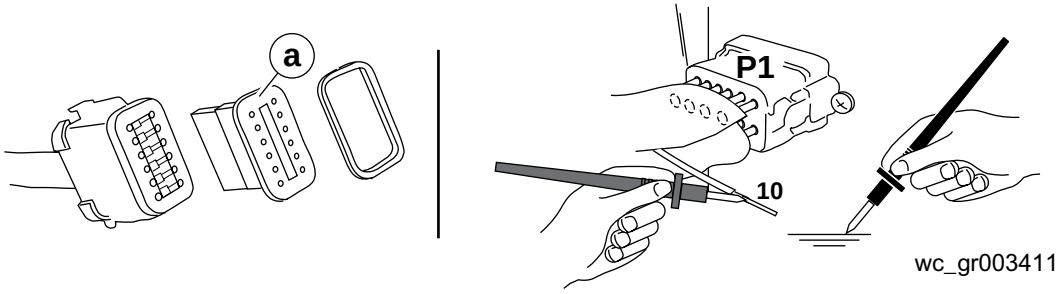
- If no voltage is measured, the left joystick has failed; replace it.
- If proper voltage is measured, continue.



wc_gr003409

7.23.5 Check the joystick ground wire. To do so, disconnect the wiring harness at P1. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the black wire from terminal #10**.** Isolate the black wire from all metal surfaces. Reinstall the orange locking plug and reconnect the connector to the control board at P1. Turn the ignition ON and check for voltage between the black wire and ground. There should be no voltage.

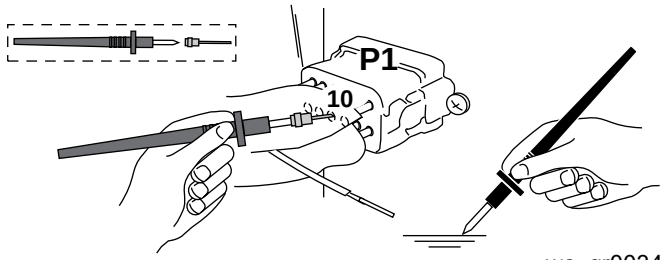
- If voltage is measured, the joystick has failed; replace it.
- If no voltage is measured, continue.



wc_gr003411

7.23.6 With the black wire still disconnected, check the control board for a voltage leak. Probe the #10 terminal of the P1 connector with the red lead, and probe a common ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect the wire to terminal #6 of the connector.



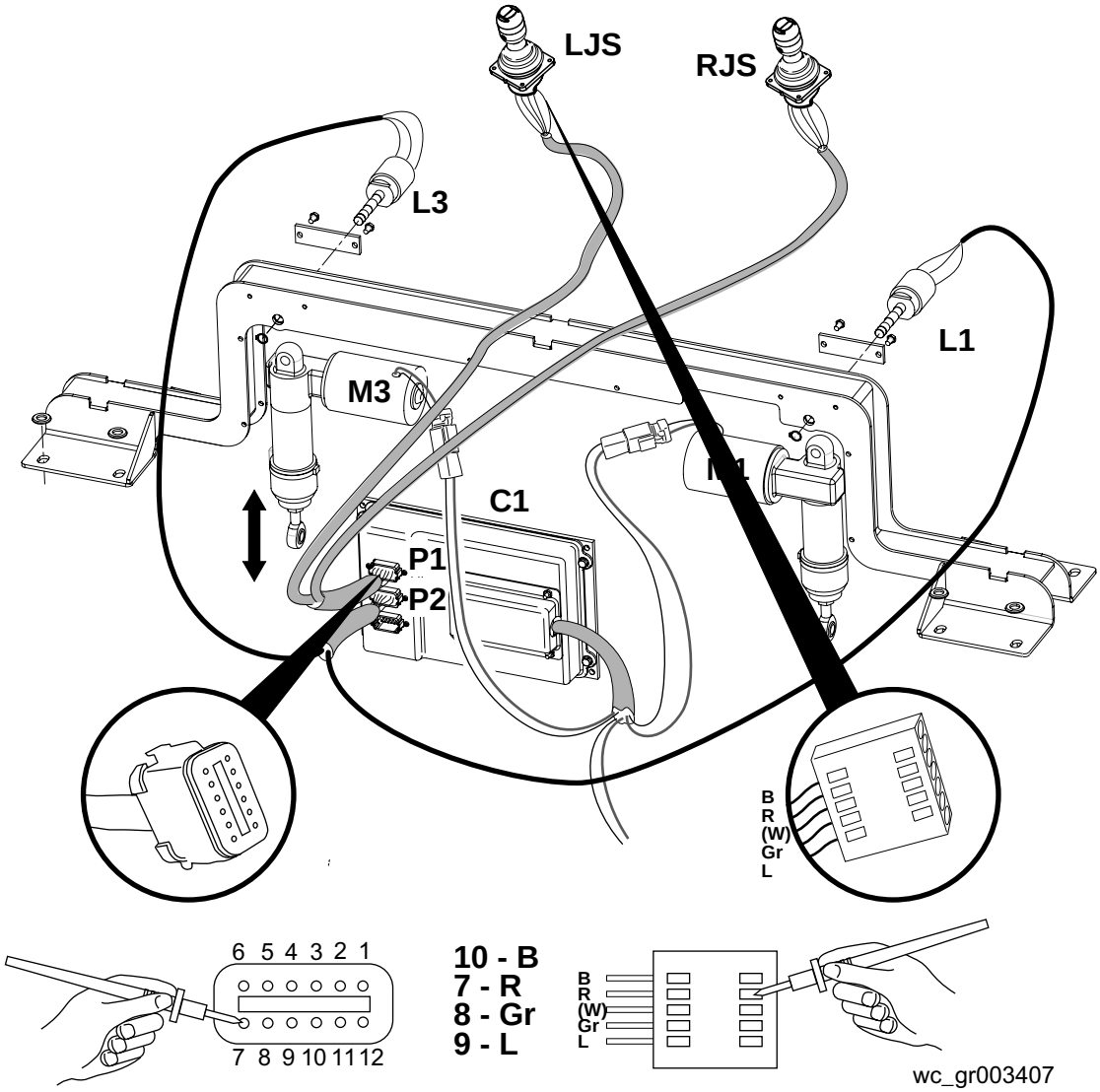
wc_gr003414

7.24 Error Code 322—Left Joystick Short Circuit

7.24.1 Check the wire connections at the joystick and at the control board connector **(P1)**. Reconnect the wiring if needed. If the fault condition remains, continue.

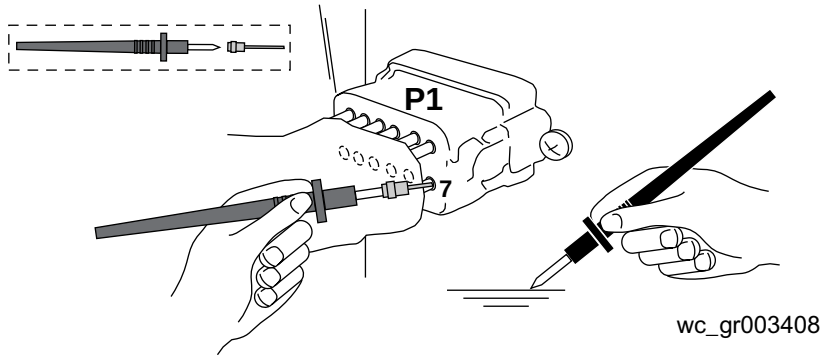
7.24.2 Check the continuity of the wiring between the control board and the joystick. To do so, disconnect the P1 connector from the control board and the wiring connector from the joystick. Then, check the continuity of the wiring between pins 7 through 10 of the P1 connector and the red (R), gray (Gr), blue (L), and black (B) wires at the joystick connector. See section *Removal and Installation of Joysticks* for joystick disassembly.

- If any of the wires is faulty, repair or replace the wiring.
- If the wiring is OK, reconnect it and continue.



7.24.3 Check for voltage at terminal #7 of the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of a multimeter to a common ground, and back probe the #7 terminal of the P1 connector with the red lead of the multimeter.The multimeter should read approximately 5.0V.

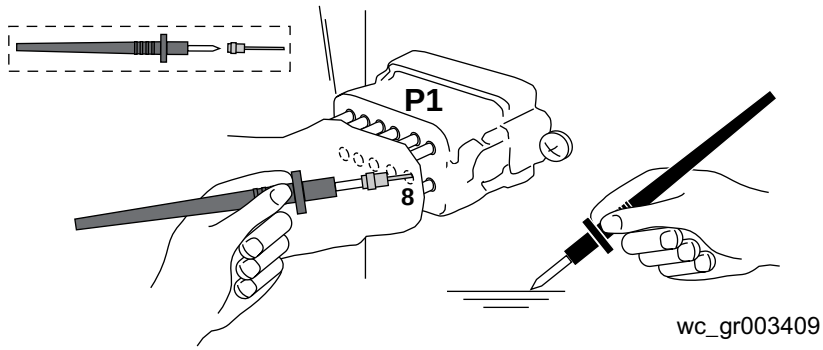
- If no voltage is measured, the control board has failed; replace it.
- If the proper voltage is measured,continue.



wc_gr003408

7.24.4 Check for feedback voltage (forward and reverse operation) from the joystick at the P1 control board connector. To do so, turn the ignition switch ON, connect the black lead of the multimeter to a common ground, and back probe the #8 terminal of the P1 connector. With the left joystick in the centered position, 2.5±0.2 Volts should be measured.

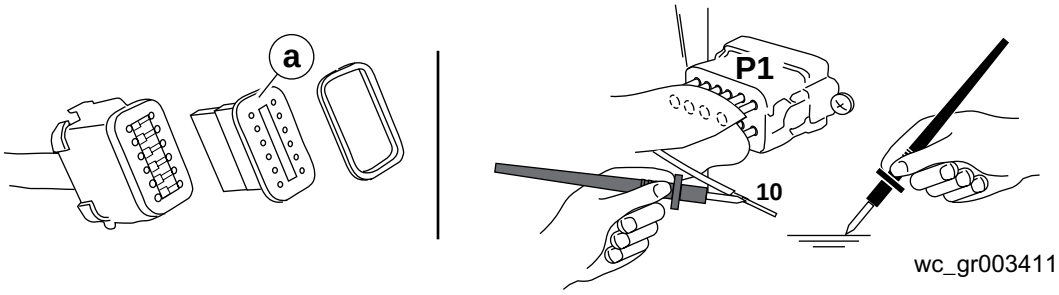
- If no voltage is measured, the left joystick has failed; replace it.
- If the proper voltage is measured, continue.



wc_gr003409

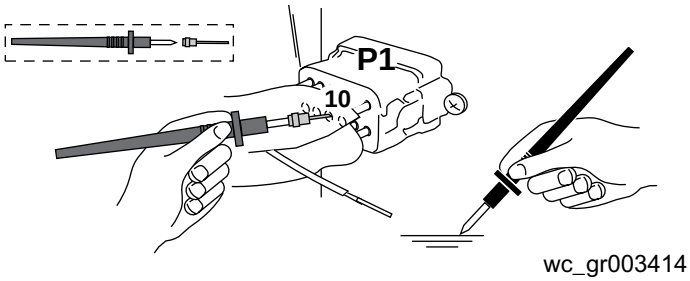
7.24.5 Check the joystick ground wire. To do so, disconnect the wiring harness at P1. Remove the orange locking plug **(a)** from the front of the connector. Use a small screwdriver to release the locking tab and remove the black wire from terminal #10**.** Isolate the black wire from all metal surfaces. Reinstall the orange locking plug and reconnect the connector to the control board at P1. Turn the ignition ON and check for voltage between the black wire and ground. There should be no voltage.

- If voltage is measured, the joystick has failed; replace it.
- If no voltage is measured, continue.



7.24.6 With the black wire still disconnected, check the control board for a voltage leak. Probe the #10 terminal of the P1 connector with the red lead, and probe a common ground with the black lead.

- If voltage is measured, the control board has failed; replace it.
- If no voltage is measured, the system should be OK. Reconnect the wire to terminal #10 of the connector.



7.24.7 After replacing any failed component, make sure to reposition the wiring harness in the correct configuration and secure it with wire ties. Turn the ignition switch ON and test the function of all three circuits: right, left, and side.

7.25 Error Code 414—Control Board Overtemperature

If a control board over-temperature condition occurs, shutdown the machine and allow the control board to cool to ambient temperature. Inspect the area surrounding the control board and remove any accumulated debris. After the machine has cooled, attempt to run the machine. If the error code reappears, replace the control panel.

7.26 Error Code 414—Control Board Overtemperature

If a low battery condition occurs, shutdown the machine.

- Inspect the battery and the wiring harness.
- Remove any corrosion from the battery terminals.
- Inspect the wiring for the actuator motors at the control panel. Remove any corrosion from the wiring.
- Check the 50A and 70A maxi-fuses. Remove any corrosion from the fuse connectors.
- Load test the battery. Recharge or replace the battery as needed. The battery must be above 11VDC.
- Test the alternator output. The alternator is rated at 65A. Replace the alternator if needed.

7.27 Removal and Installation of Actuator Load Pins

See Graphic: wc_gr003445

Removal:

7.27.1 Turn the key switch to the OFF position.

7.27.2 The trowel should be on a flat surface with the blades pitched flat.

7.27.3 For the rear actuator (left/right steering), remove the protective cover **(a)**.

7.27.4 Disconnect the load pin wiring connector **(b)**.

7.27.5 Remove the retaining ring **(c)** from the shaft.

7.27.6 Support the actuator and carefully remove the load pin **(d)**. To prevent damage to the actuator, secure it in the upright position.

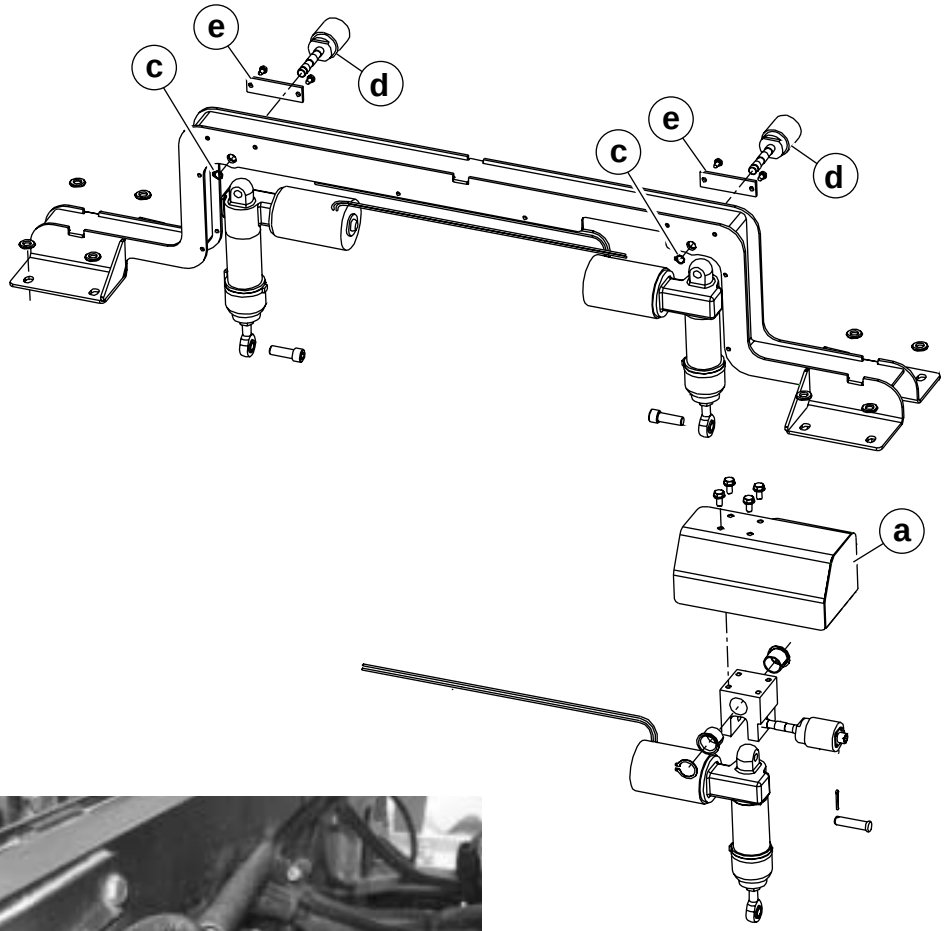
Installation:

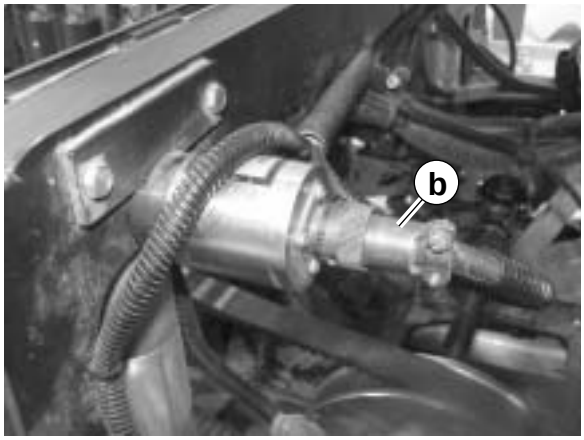
7.27.7 Rotate the load pin **(d)** so the alignment flat will engage the locking plate **(e)**. Align the mounting hole of the actuator with the frame and carefully insert the load pin **(d)**.

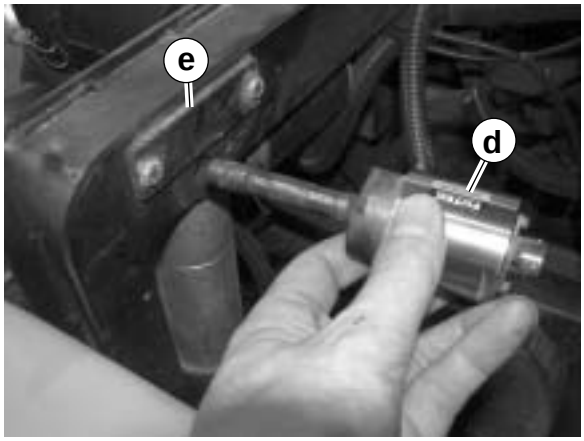
7.27.8 Install the retaining ring **(c)**. Make sure the retaining ring is fully engaged into the shaft groove.

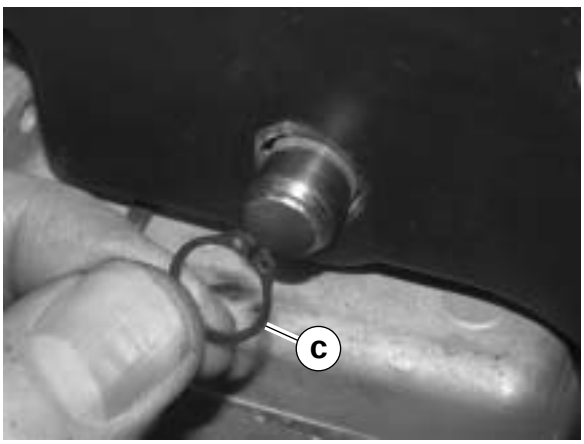
7.27.9 Reconnect the load pin wiring connector **(b)**.

7.27.10 Install the protective cover **(a)** on the rear actuator if it was removed.









wc_gr003445

7.28 Removal and Installation of Actuators

See Graphic: wc_gr003446

Removal**:**

7.28.1 Turn off the machine.

7.28.2 Remove lower actuator mounting bolt or pin **(a)**.

7.28.3 Remove the load pin **(b)** and carefully remove the actuator **(c)** from the machine. See section *Removal and Replacement of Actuator Load Pins*.

Installation:

The actuator length should be checked every time the actuator is removed from the machine. Adjust the actuator length before installation. To adjust the actuator length:

7.28.4 Loosen the locknut **(d)** and rotate the barrel **(e)** clockwise until it stops retracting.

7.28.5 Rotate the barrel counterclockwise to achieve the dimension shown.

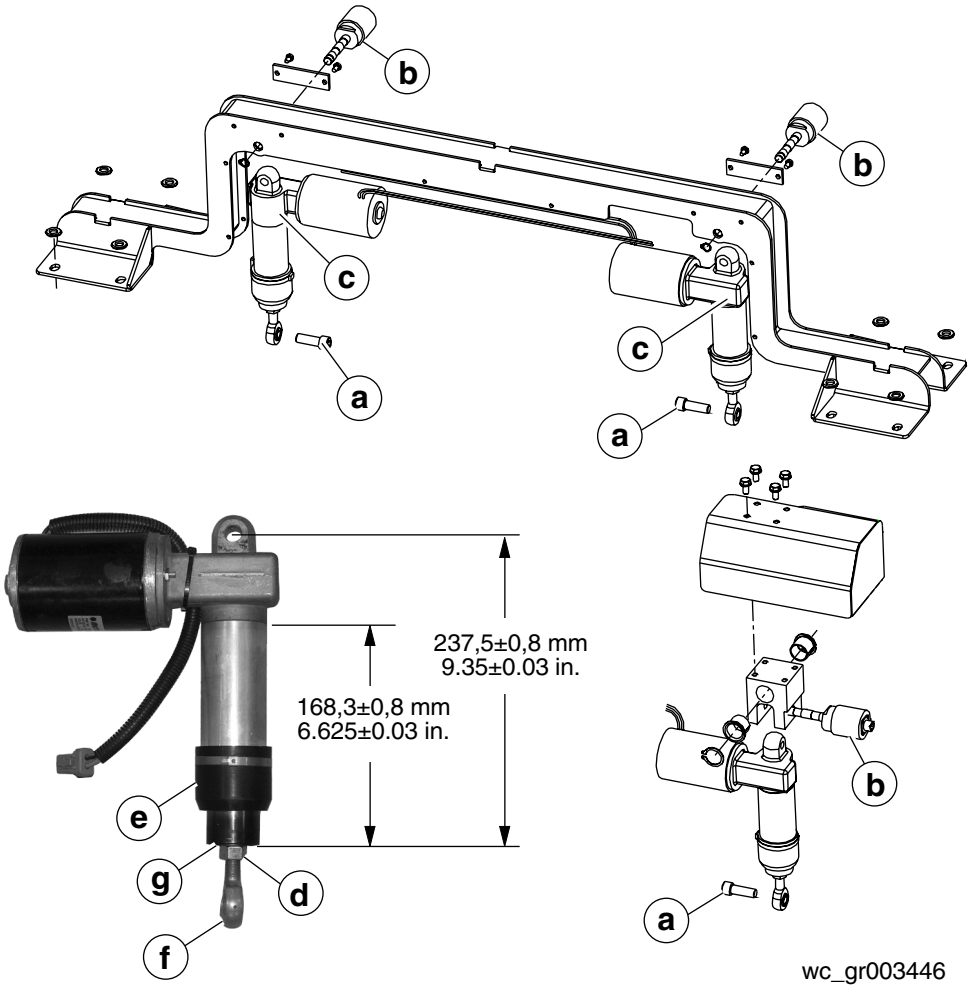
7.28.6 Install the load pin **(b)**. See section *Removal and Replacement of Actuator Load Pins*.

7.28.7 With the blades pitched flat and the trowel flat on the ground, screw the rod end **(f)** in or out (while holding the barrel **(e)** so it does not rotate) so that the rod end aligns with the mounting hole in the gearbox pivot rod.

7.28.8 Apply Loctite 243 or an equivalent to the mounting screw **(a)** and reinstall it through the rod end and into the gearbox pivot rod. Torque the mounting screw to 77 ± 8 Nm (57 ± 6 ft.lbs.).

7.28.9 Apply Loctite 243 or an equivalent to the threads **(g)** above the locknut **(d)** on the rod end. Using a band clamp or slip joint pliers to hold the barrel, tighten the locknut to 41 ± 7 Nm (30 ± 5 ft.lbs.).

7.28.10 Turn the key switch to the ON position and test the actuator function(s).


b
b
c
c
a
a
237,5±0,8 mm
9.35±0.03 in.
168,3±0,8 mm
6.625±0.03 in.
e
g
d
f
b
a
wc_gr003446

7.29 Removal and Installation of Joysticks

See Graphic: wc_gr003447

Removal:

7.29.1 Disconnect the battery.

7.29.2 Remove the screws **(a)** that secure the joystick assembly to the machine and lift the joystick assembly off. **Note:** *The joystick will still be connected to the machine by the wiring harness **(b)***.

7.29.3 Unplug the wiring harness from the joystick.

7.29.4 Remove the screws **(c)**, washers, and nuts that secure the joystick in the housing.

7.29.5 Lower the joystick **(d)** and the backing plate **(e)** from the housing.

Installation:

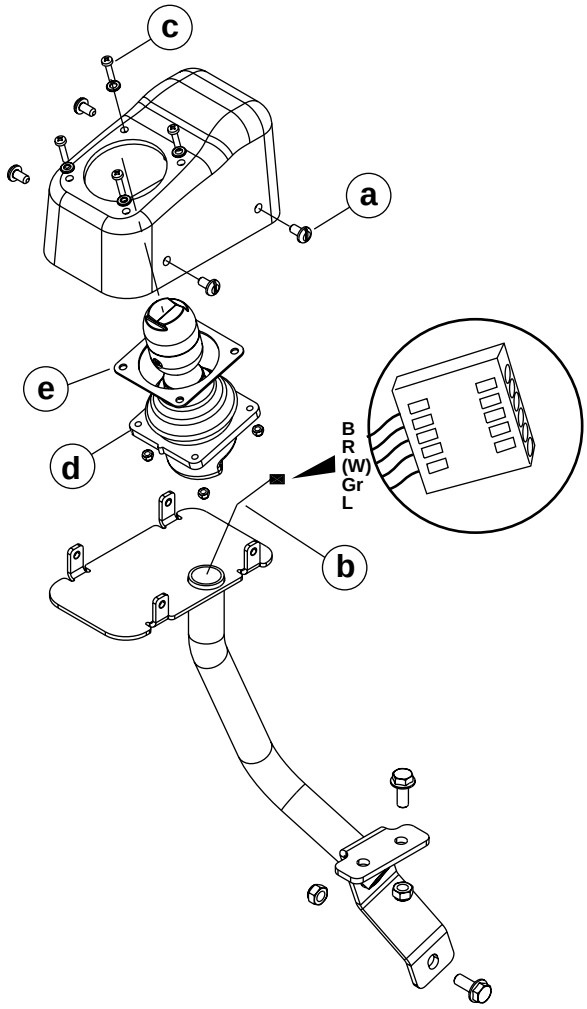
7.29.6 Position the backing plate **(e)** onto the joystick **(d)**.

7.29.7 Insert the joystick into the housing from underneath the housing. Insert the screws **(c)** with washers into the top of the housing and through the backing plate. Install the locknuts and tighten.

7.29.8 Carefully connect the wiring harness **(b)** to the joystick.

7.29.9 Lower the joystick assembly onto the mount. Apply Loctite 243 or an equivalent to the screws and install.

7.29.10 Reconnect the battery. Turn the key switch to the ON position and check the function of the joystick.



wc_gr003447

7.30 Removal and Installation of Electric Steer Control Board

See Graphic: wc_gr003441

Removal**:**

7.30.1 Disconnect the battery.

7.30.2 Disconnect the gray and black connectors **(a** and **b)** from the control board.

7.30.3 Remove the nuts securing the protective cover **(c)** and remove the protective cover.

7.30.4 Label the motor control wires before disconnecting them from the control board. Once labelled, remove the motor control wires from the control board.

7.30.5 Remove the mounting screws **(d)** holding the control board onto the front panel and remove the control board.

Installation**:**

7.30.6 Inspect the control board. Make sure the insulating strips **(e)** are attached to the back of the board. DO NOT INSTALL THE CONTROL BOARD WITHOUT THE INSULATORS INSTALLED! The back of the control board has battery-positive terminals on it that may short without the insulating strip installed.

7.30.7 Place a drop of medium strength thread-lock compound onto the mounting screws **(d)** for the control board and install it. Torque the screws to 10 Nm (7 ft.lbs.).

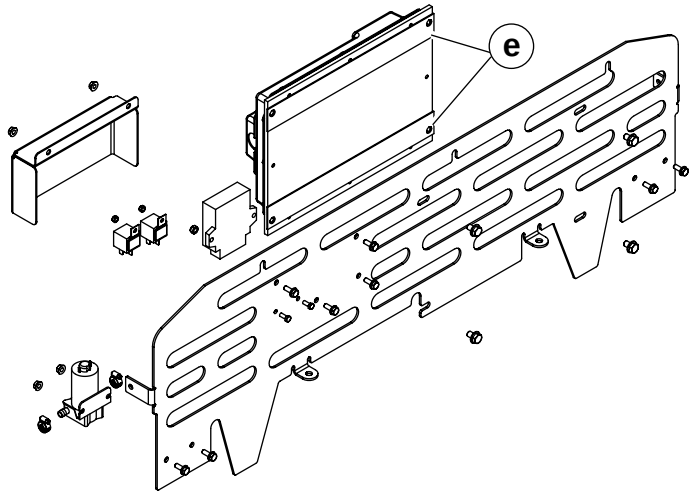
7.30.8 Install the motor control wires onto the terminals of the control board. Do not over-tighten the nuts when connecting the wires.

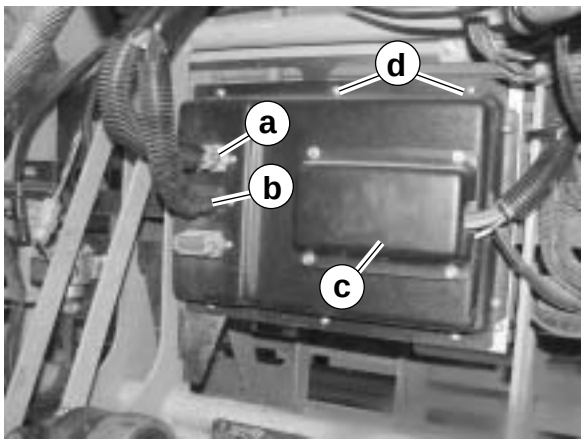
7.30.9 Install the protective cover **(c)**.

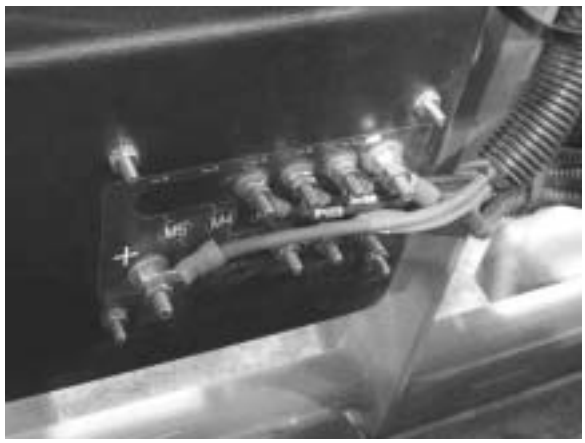
7.30.10 Connect the gray connector **(a)** to the gray receptacle and the black connector **(b)** to the black receptacle on the control board.

7.30.11 Reconnect the battery.

7.30.12 Turn the key switch ON and test all control board functions.



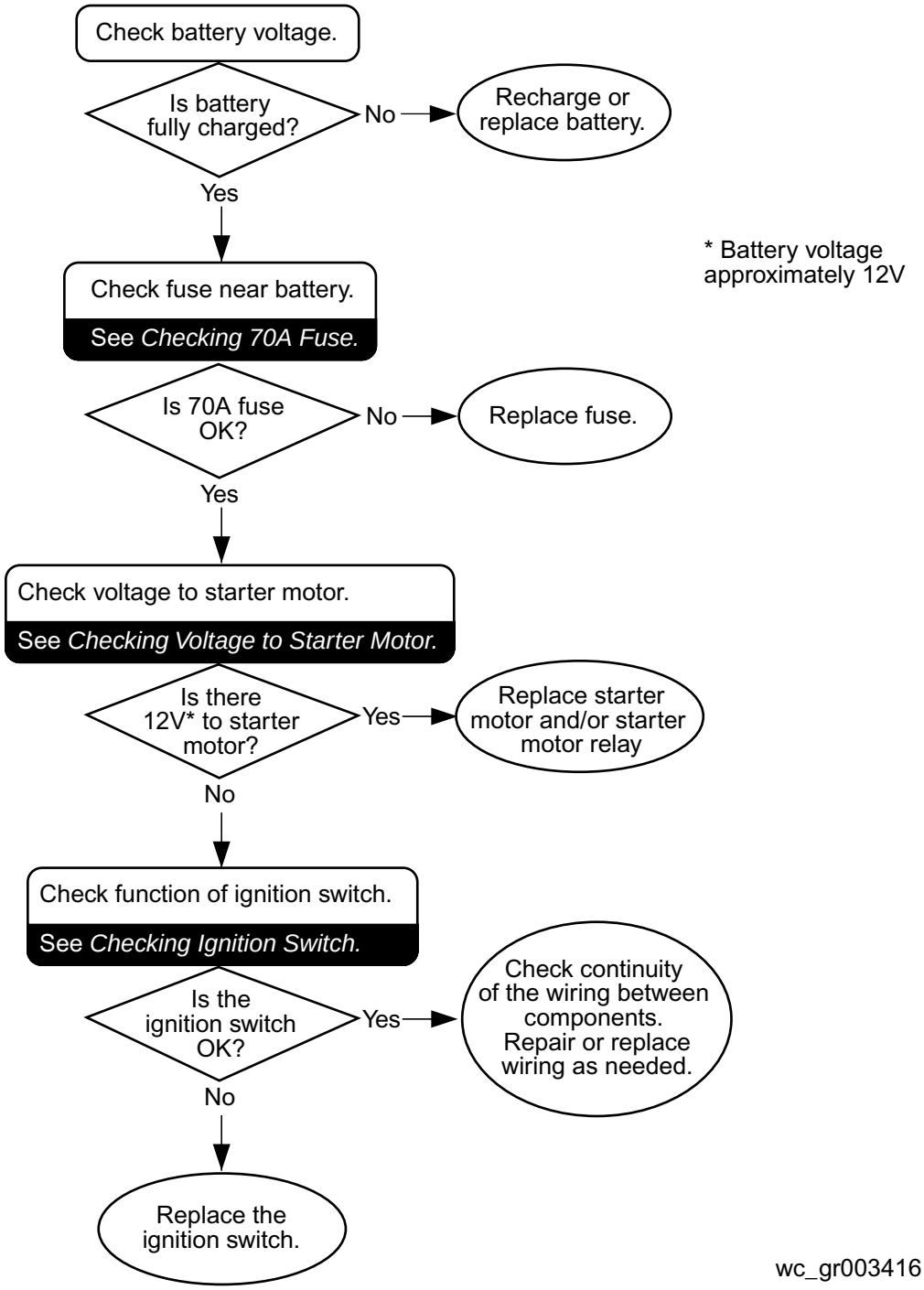




wc_gr003441

8. Engine Troubleshooting and Replacement

8.1 Vanguard Engine Does Not Crank—Flowchart 1A



8.2 Checking 70A Fuse

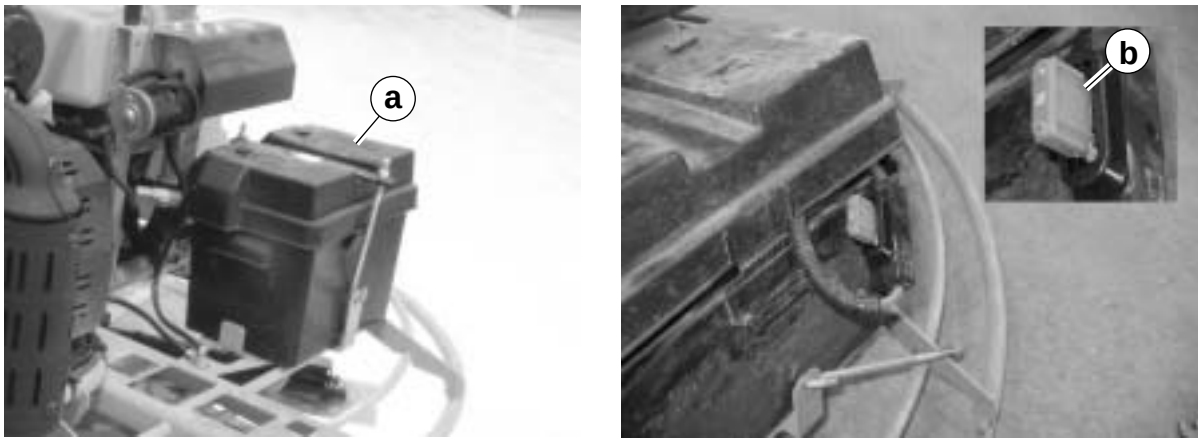
See Graphic: wc_gr003432

There are two 70A fuses in the electrical system. One of the fuses protects the electric steer circuit; the other protects the engine starting circuit. To check the 70A fuse that protects the engine starting circuit, carry out the following procedure:

8.2.1 Remove the screws that secure the battery cover **(a)**.

8.2.2 Remove the protective cover that protects the fuse **(b)**.

8.2.3 If the fuse is blown, replace it.



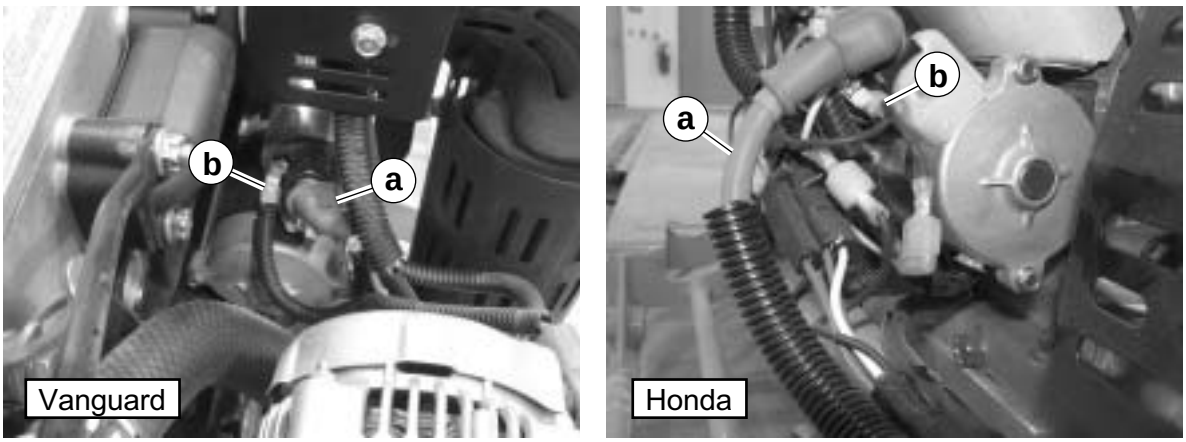
wc_gr003432

8.3 Checking Voltage to Starter Motor

See Graphic: wc_gr003435

Battery voltage is provided directly to the starter motor via the red wire **(a)**. Check that the red wire is securely fastened to the starter motor.

Battery voltage is also provided to the starter solenoid via the black wire **(b)** when the ignition switch is in the START position. This wire has a female spade connector. Check that it is connected securely to the starter solenoid. Clean the terminal if necessary.



wc_gr003435

8.4 Checking Ignition Switch

See Graphic: wc_gr003434

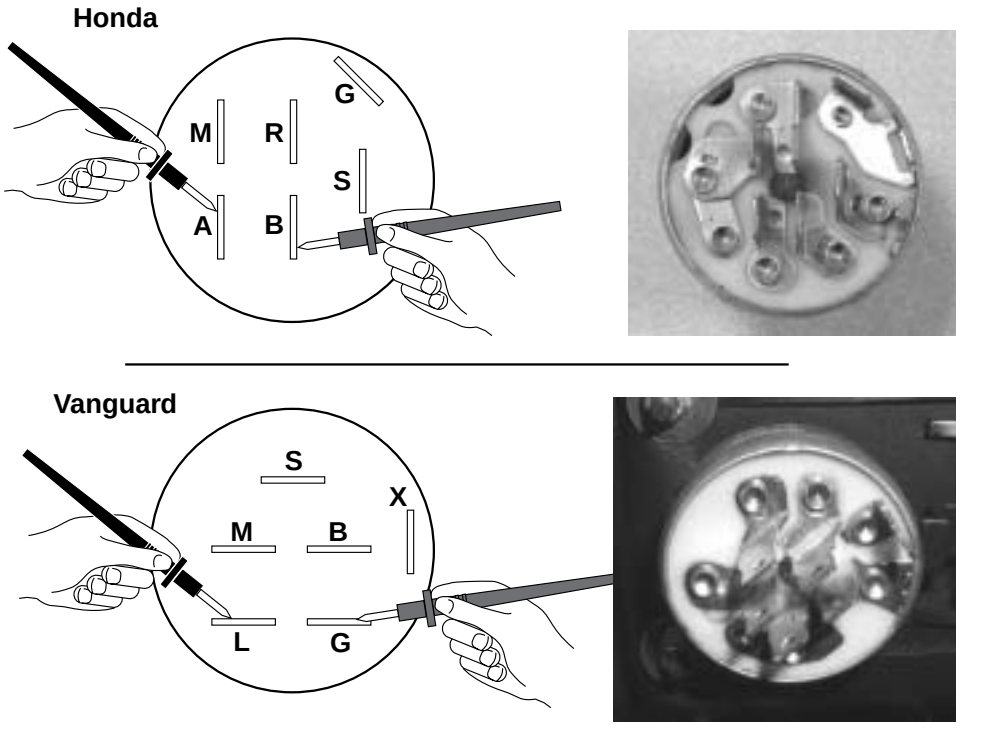
The ignition switch may be checked either installed into or removed from the control panel. Check the continuity between each terminal when the ignition switch is in each of its positions: OFF, ON, and START.

Table 1: Honda

Key position	Continuity between terminals
OFF	M–G, M–A, G–A
ON	R–B, R–A, B–A
START	S–B

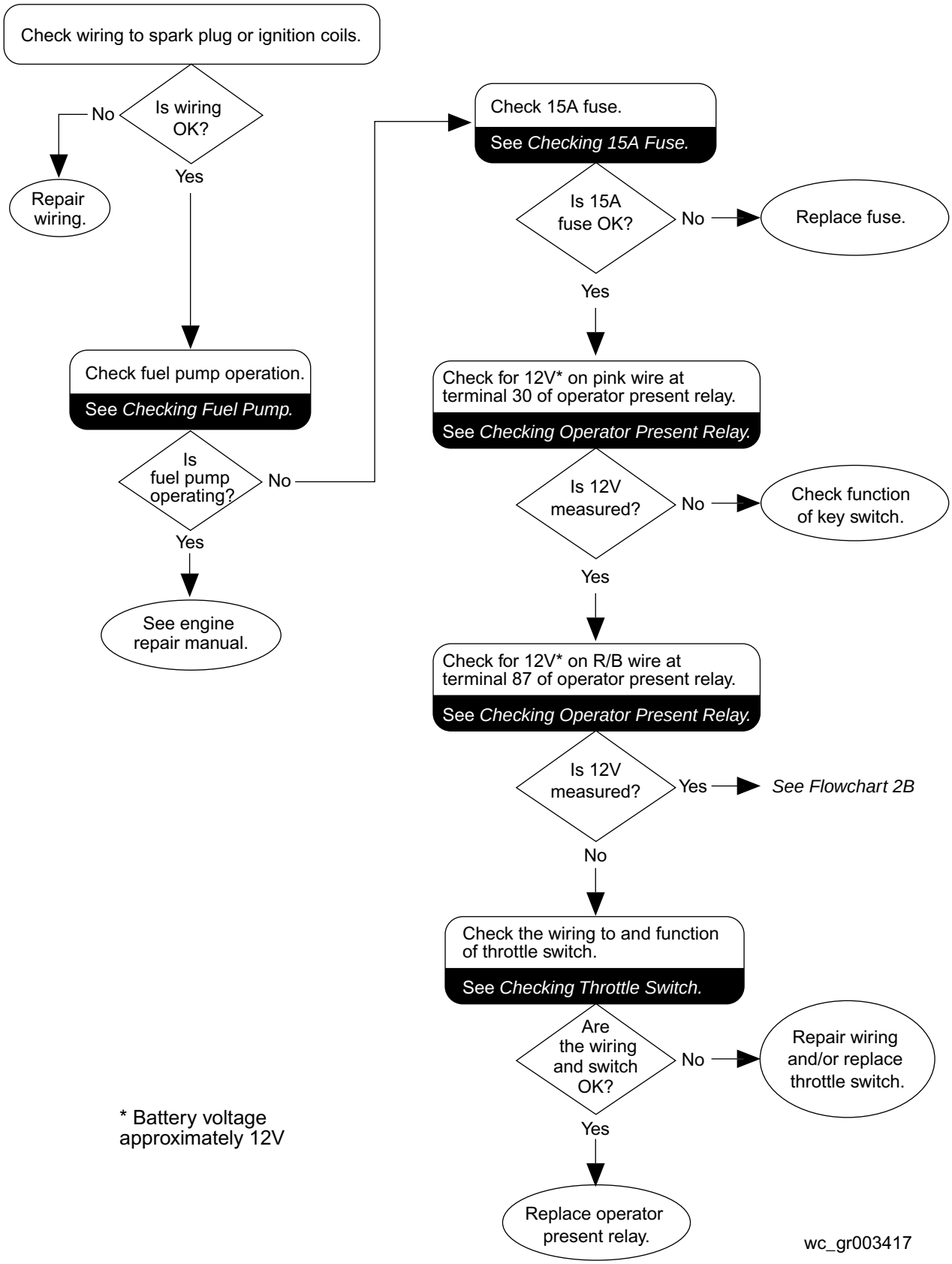
Table 2: Vanguard

Key position	Continuity between terminals
OFF	M–G, M–X
ON	L–B, L–X, B–X
START	S–B, L–S, L–B



wc_gr003434

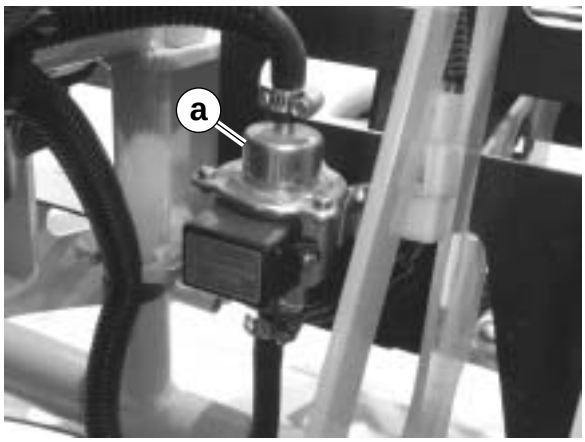
8.5 Vanguard Engine Cranks but does not Start—Flowchart 2A



8.6 Checking Fuel Pump

See Graphic: wc_gr003437

The fuel pump **(a)** is mounted inside the frame on the left hand side. By checking the operation of the fuel pump one can determine quickly if the problem is associated with the machine's circuitry or with the engine itself. When the key switch is in the ON position, power should flow to the fuel pump. When the fuel pump receives electric power, you can hear and feel it run. If the fuel pump does not make any noise when the key switch is in the ON position, it is not receiving power. The problem is within the circuitry of the machine. Start troubleshooting by checking the wiring to the fuel pump; continue with checking the 15A fuse. If the fuel pump is receiving power and pumping fuel to the engine, the problem is within the engine. See the engine manufacturer's repair manual. If the fuel pump is receiving power but not pumping, the fuel pump has failed; replace it.

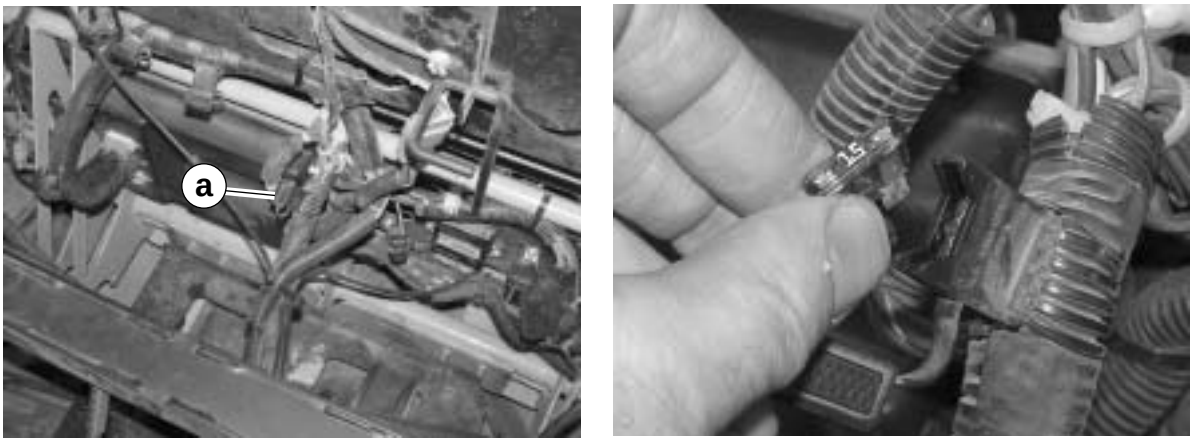


wc_gr003437

8.7 Checking 15A Fuse

See Graphic: wc_gr003436

The 15A fuse **(a)** protects the electronic control module, the operator presence relay, and the associated components down stream of the operator presence relay—the fuel relay, fuel pump, anti-afterfire solenoid, and the ignition module. If this fuse is blown, the engine will crank but it will not start. To check the 15A fuse, remove the protective cover and pull the fuse from the harness. If the fuse is blow; replace it.



wc_gr003436

8.8 Checking Operator Presence Relay

See Graphic: wc_gr003433

The operator presence relay **(a)** is located behind a protective cover mounted to the machine frame. Battery voltage is sent to terminals 30 and 85 of the operator presence relay by the key switch via the pink wires. To check the voltage at the operator presence relay, carry out the following procedure:

8.8.1 Remove the protective cover.

8.8.2 Cut the wire ties that secure the operator presence relay.

8.8.3 Slide the connector down the terminals of the relay so that you can probe the terminals with the lead of a multimeter.

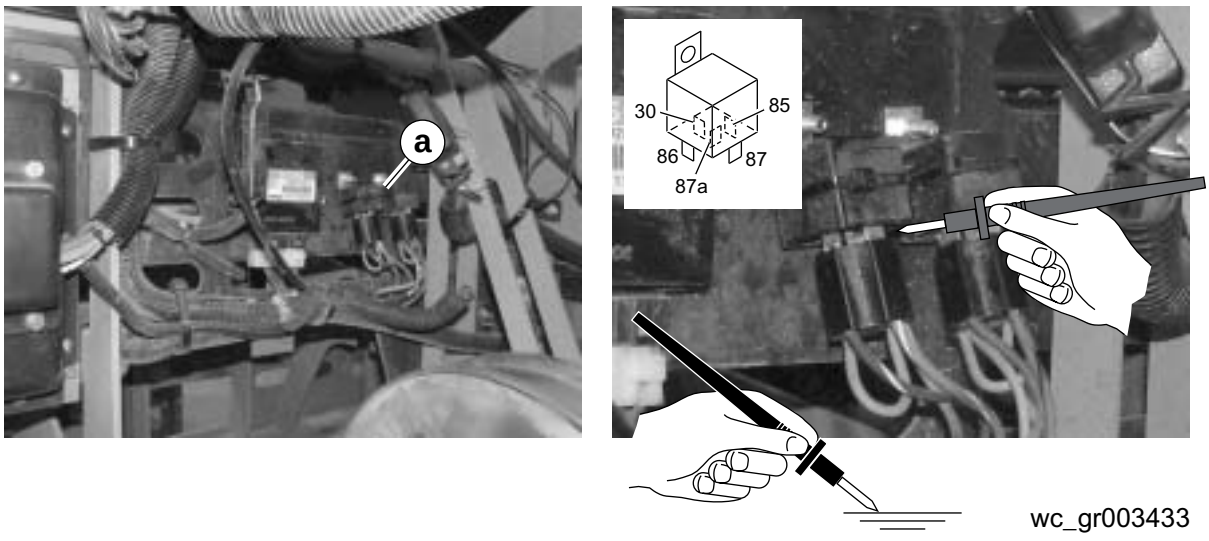
8.8.4 Turn the ignition switch to the ON position.

8.8.5 Check for battery voltage between terminal 30 and ground.

- If battery voltage is measured, the operator presence relay is receiving power.
- If battery voltage is not measured, check the continuity of the wiring between the operator presence relay and the ignition switch. Repair or replace the wiring as needed.

8.8.6 Next, check if power is being switched through the operator presence relay by checking for battery voltage between terminal 87 of the operator presence relay and ground.

- If battery voltage is measured, the operator presence relay is functioning.
- If battery voltage is not measured, the operator presence relay is not functioning. Check the wiring to and function of the throttle switch.



wc_gr003433

8.9 Checking Wiring to and Function of Throttle Switch

See Graphic: wc_gr003438

In order for the operator presence relay to energize, the circuit through the coil side of the relay (terminals 85 and 86) must be completed. This is done through the throttle switch. The L/Br wire runs from terminal 86 of the operator presence relay to the throttle switch (and to the operator presence switch). The throttle switch is a normally closed switch and thus the circuit is completed when the throttle pedal is in the idle position. As soon as the throttle pedal is pressed, the circuit is broken and the operator presence relay will de-energize. However, if the operator is in the seated position, the operator presence switch, which is normally open, will close. The circuit for the operator presence relay is now completed by the operator presence switch, which keeps the operator presence relay energized, and allows the machine to function. To check the function of the throttle switch, carry out the following procedure:

8.9.1 Disconnect the wiring to the throttle switch **(a)**.

8.9.2 Insert the leads of a multimeter into the wires coming from the throttle switch.

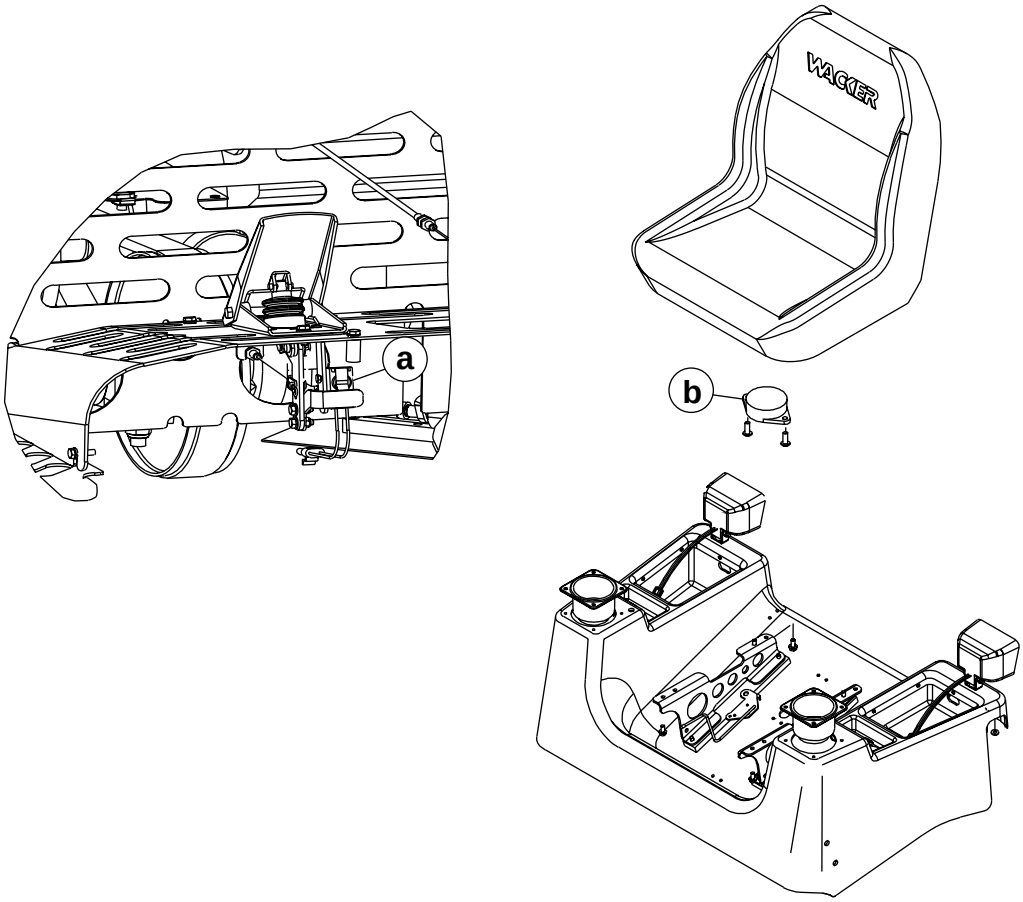
8.9.3 Test the throttle switch for continuity when the throttle pedal is pressed and when in the idle position (not pressed). There should be continuity across the throttle switch when the throttle pedal is in the idle position and no continuity when the throttle pedal is pressed.

- If the throttle switch functions accordingly, it is OK.
- If the throttle switch does not function accordingly, it has failed; replace it.

8.9.4 Test the operator presence switch **(b)** in the same manner. It is a normally open switch and thus should only have continuity when the operator is in the seated position.

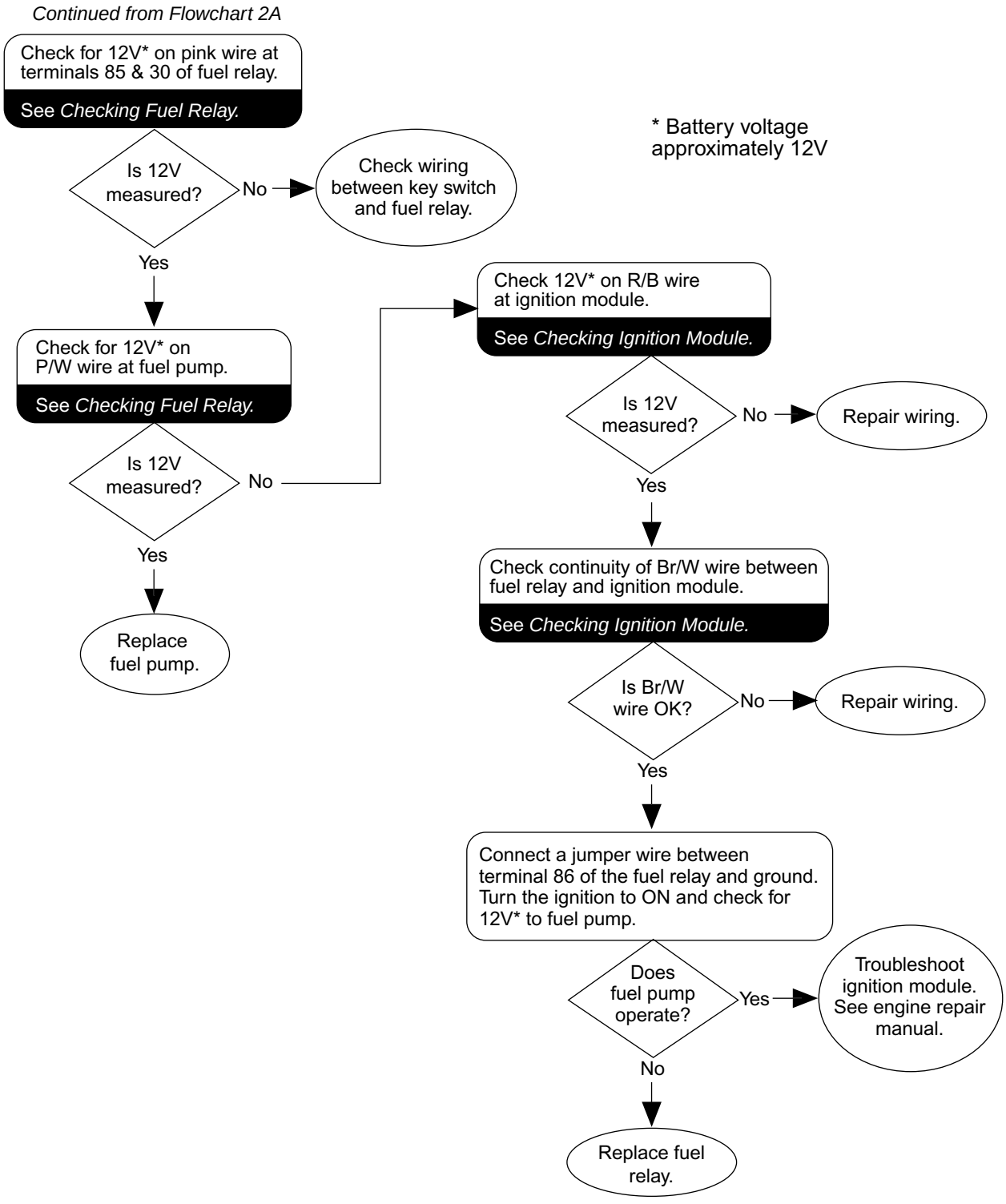
- If the operator presence switch functions accordingly, it is OK.
- If the operator presence switch does not function accordingly, it has failed; replace it.

8.9.5 If the throttle switch is OK, check the continuity of the wiring between the throttle switch and the operator presence relay.



wc_gr003438

8.10 Vanguard Engine Cranks but does not Start—Flowchart 2B


Continued from Flowchart 2A
Check for 12V* on pink wire at terminals 85 & 30 of fuel relay.
See Checking Fuel Relay.
Is 12V measured?
No
Check wiring between key switch and fuel relay.
Yes
Check for 12V* on P/W wire at fuel pump.
See Checking Fuel Relay.
Is 12V measured?
No
Yes
Replace fuel pump.
Check 12V* on R/B wire at ignition module.
See Checking Ignition Module.
Is 12V measured?
No
Repair wiring.
Yes
Check continuity of Br/W wire between fuel relay and ignition module.
See Checking Ignition Module.
Is Br/W wire OK?
No
Repair wiring.
Yes
Connect a jumper wire between terminal 86 of the fuel relay and ground. Turn the ignition to ON and check for 12V* to fuel pump.
Does fuel pump operate?
Yes
Troubleshoot ignition module. See engine repair manual.
No
Replace fuel relay.
* Battery voltage approximately 12V

wc_gr003418

8.11 Checking Fuel Relay

See Graphic: wc_gr003439

The fuel relay **(a)** is located behind a protective cover mounted to the machine frame. Battery voltage is sent to terminals 30 and 85 of the fuel relay by the key switch via the pink wires. To check the voltage at the fuel relay, carry out the following procedure:

8.11.1 Remove the protective cover.

8.11.2 Cut the wire ties that secure the operator presence relay.

8.11.3 Slide the connector down the terminals of the relay so that you can probe the terminals with the lead of a multimeter.

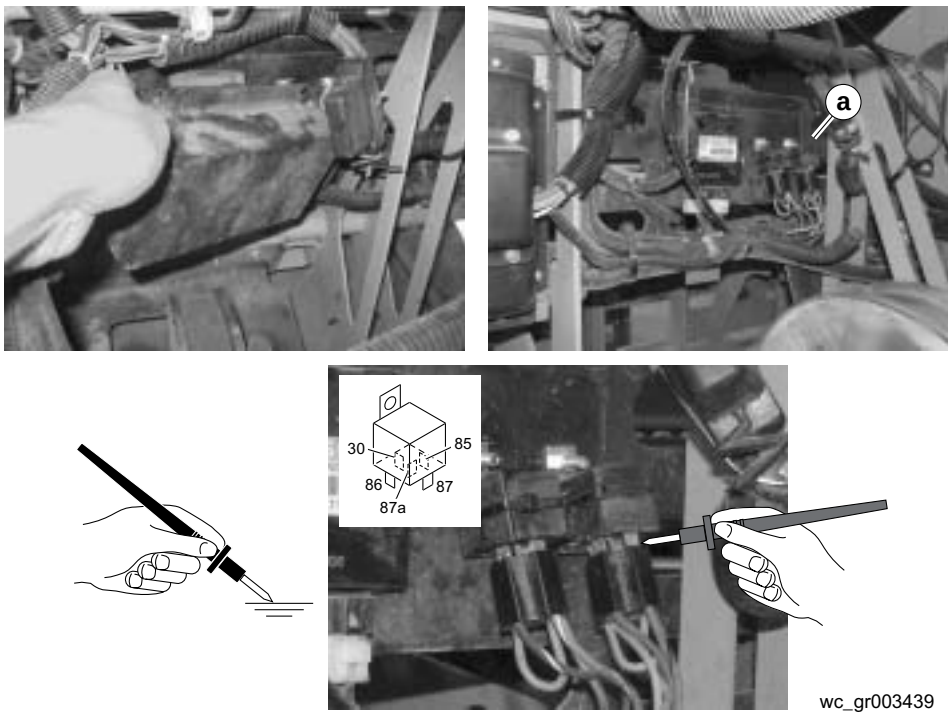
8.11.4 Turn the ignition switch to the ON position.

8.11.5 Check for battery voltage between terminal 30 and ground.

- If battery voltage is measured, the fuel relay is receiving power.
- If battery voltage is not measured, check the continuity of the wiring between the operator presence relay and the fuel relay. Repair or replace the wiring as needed.

8.11.6 Next, check if power is being switched through the fuel relay by checking for battery voltage between terminal 87 of the fuel relay and ground.

- If battery voltage is measured, the fuel relay is functioning.
- If battery voltage is not measured, the fuel relay is not functioning. Check the wiring to and function of the ignition module.



wc_gr003439

8.12 Checking Ignition Module

See Graphic: wc_gr003440

The ignition module **(a)** is located behind a protective cover mounted to the machine frame. Battery voltage is sent to the ignition module via the P wire connected to the R/B wire from the operator presence relay. To check the voltage at the ignition module, carry out the following procedure:

8.12.1 Remove the protective cover.

8.12.2 Remove the left side connector **(b)**.

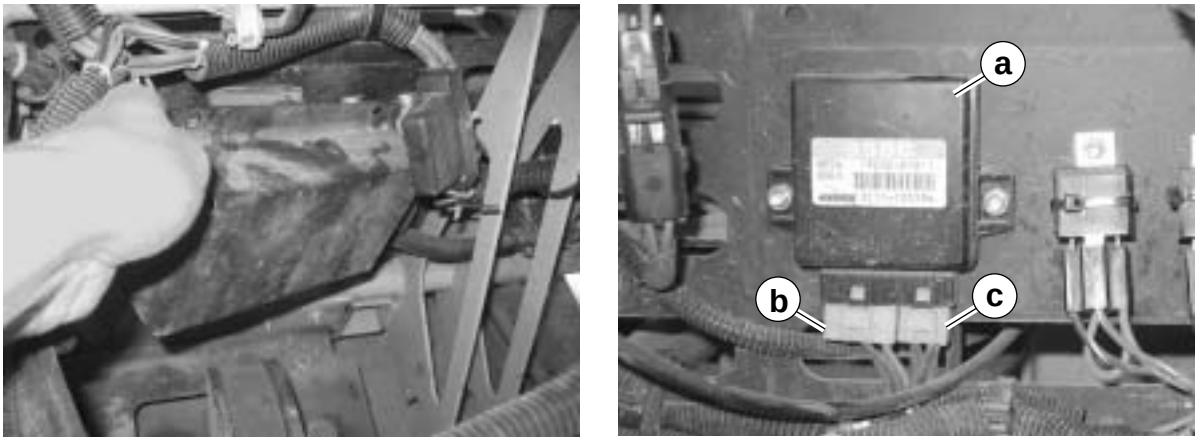
8.12.3 Turn the ignition switch to the ON position.

8.12.4 Check for battery voltage between the P wire and ground.

- If battery voltage is measured, the ignition module is receiving power.
- If battery voltage is not measured, check the continuity of the wiring between the operator presence relay and the ignition module. Repair or replace the wiring as needed.

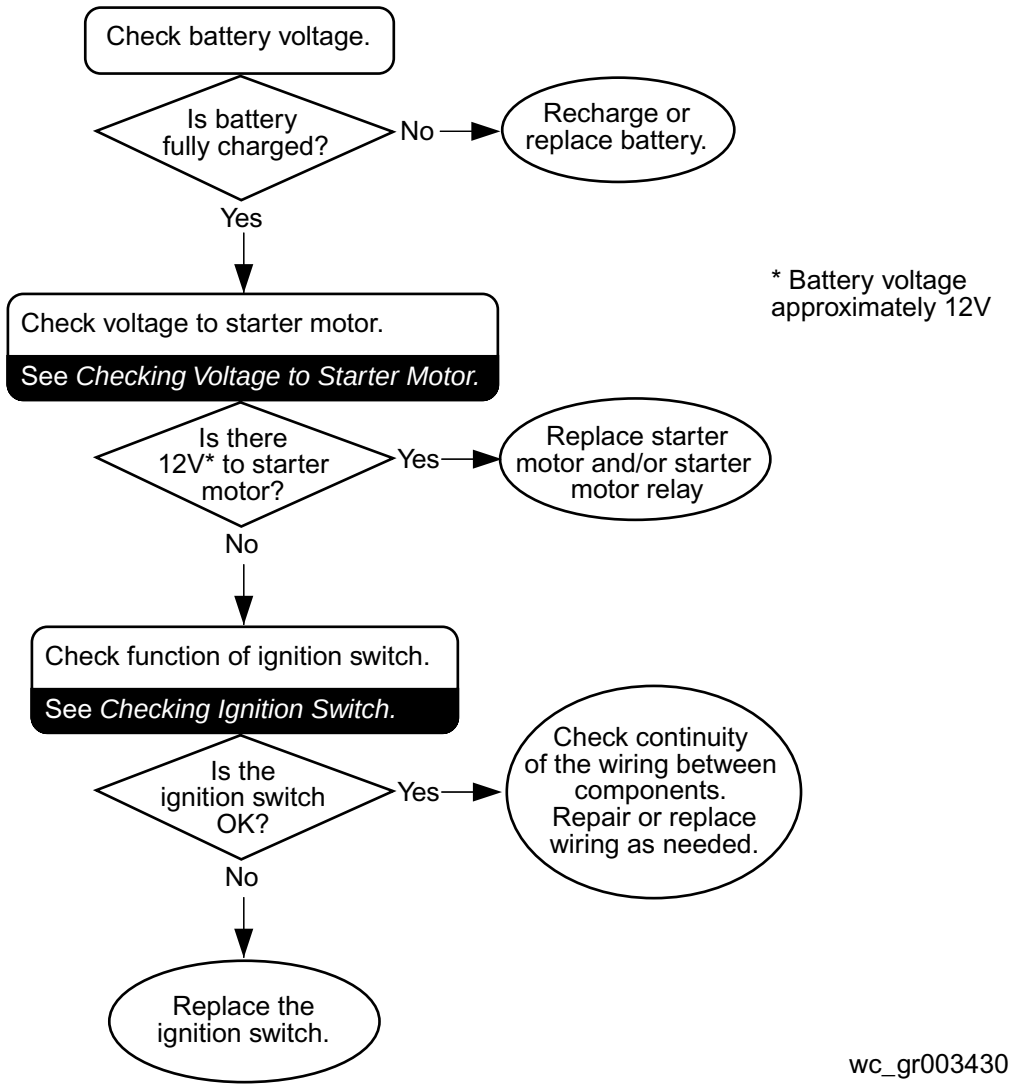
8.12.5 Next, check the continuity of the Br/W wire from the ignition module (right side connector **(c)**) to terminal 86 of the fuel relay.

- If the wire has no continuity, replace it.
- If the wire has continuity, see the engine manufacturer's repair manual for troubleshooting the ignition module.



wc_gr003440

8.13 Honda Engine Does Not Crank—Flowchart 3A



8.14 Removing the Honda Engine

See Graphic: wc_gr003431

This procedure requires a lift or crane capable of lifting 136 kgs. (300 lbs.).

8.14.1 Position the trowel on a flat surface.

8.14.2 Disconnect the battery.

8.14.3 Remove the drive belt. See section *Belt Replacement*.

8.14.4 Close the fuel valve on the fuel tank.

8.14.5 Disconnect the fuel hose **(a)** from the fuel filter.

8.14.6 Remove the screws that secure the cross brace **(b)** and remove the cross brace.

8.14.7 Disconnect the wiring from the starter motor **(c)**.

8.14.8 Cut the tie wraps, and disconnect the relays from the engine **(d)**.

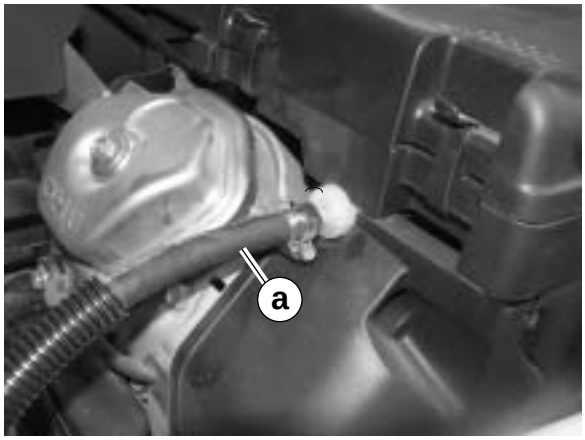
8.14.9 Remove the screw **(e)** and remove the ground wires from the engine.

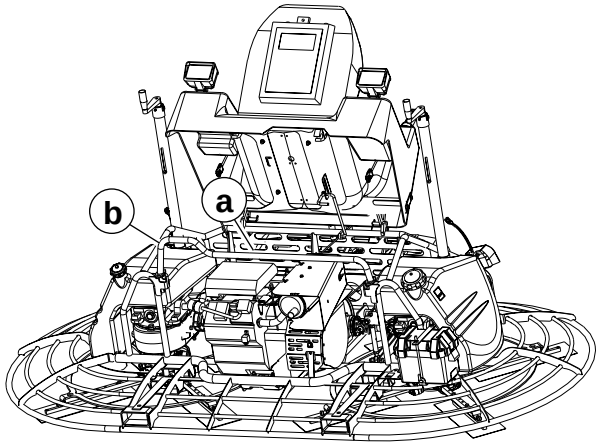
8.14.10 Disconnect the throttle **(f)** and choke cable **(g)**.

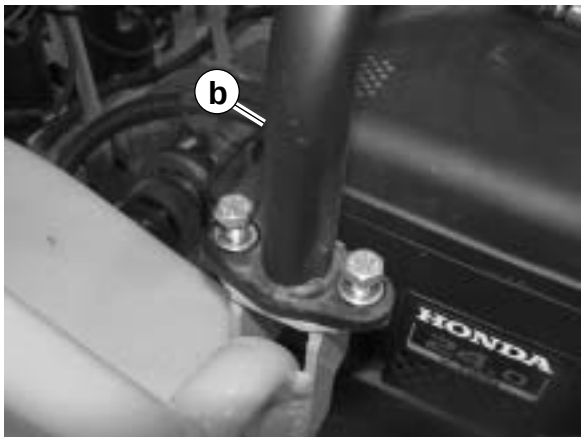
8.14.11 Disconnect the three wires of the oil pressure switch harness **(h)**.

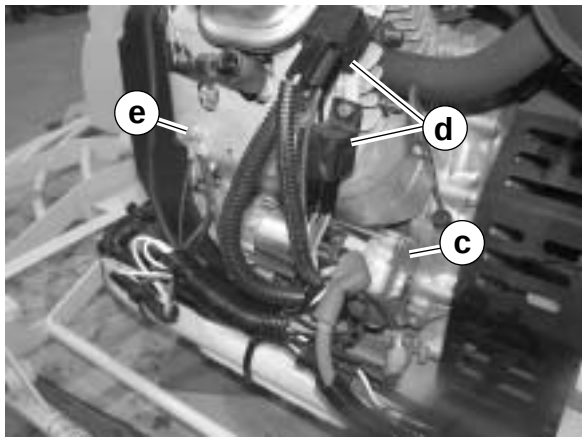
8.14.12 Remove the engine mounting bolts from underneath the machine. When removing the engine mounting bolts also remove the battery ground cable from the engine.

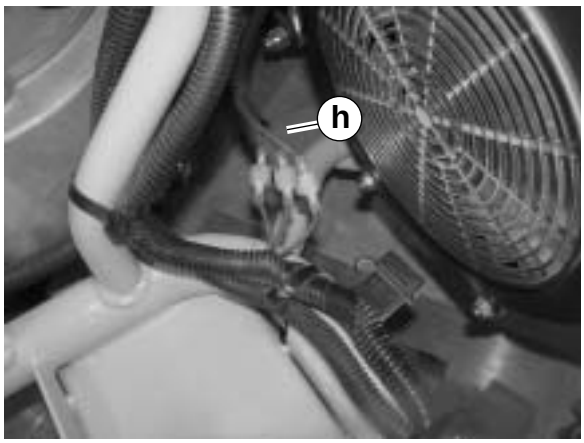
8.14.13 Using an appropriate lift or crane, lift the engine from the machine.

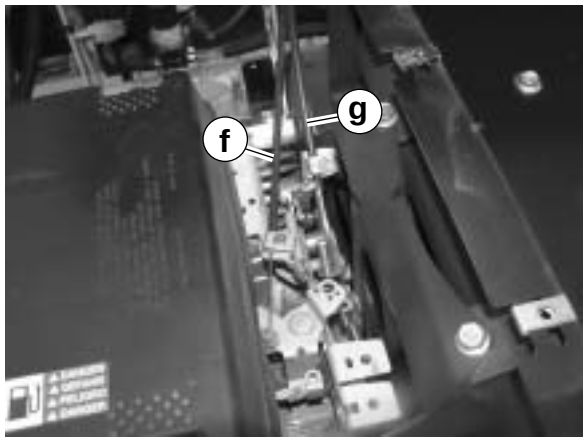












wc_gr003431

8.15 Installing the Honda Engine

See Graphic: wc_gr003431

This procedure requires a lift or crane capable of lifting 136 kgs. (300 lbs.).

8.15.1 Position the engine onto the machine's frame.

8.15.2 Temporarily secure the engine and the battery ground cable to the machine with four bolts from underneath the machine.

8.15.3 Reconnect the three wires of the oil pressure switch harness **(h)**.

8.15.4 Reconnect the throttle **(f)** and choke cable **(g)**.

8.15.5 Reinstall the screw **(e)** and the ground wires to the engine.

8.15.6 Reconnect the relays to the engine **(d)** and secure them with wire ties.

8.15.7 Reconnect the wiring to the starter motor **(c)**.

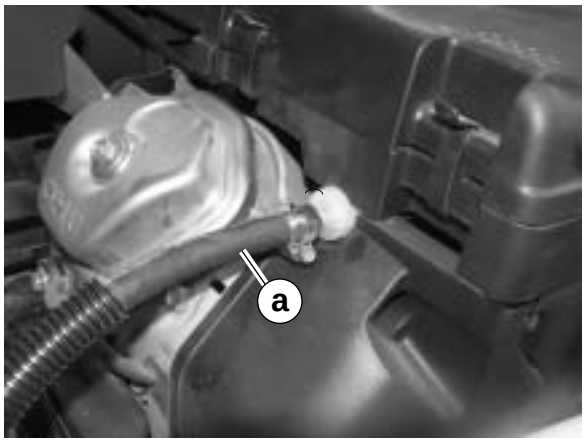
8.15.8 Reinstall the cross brace **(b)**.

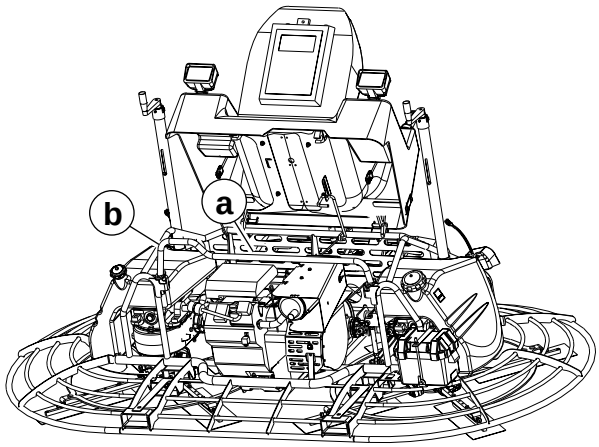
8.15.9 Reconnect the fuel hose **(a)** to the fuel filter.

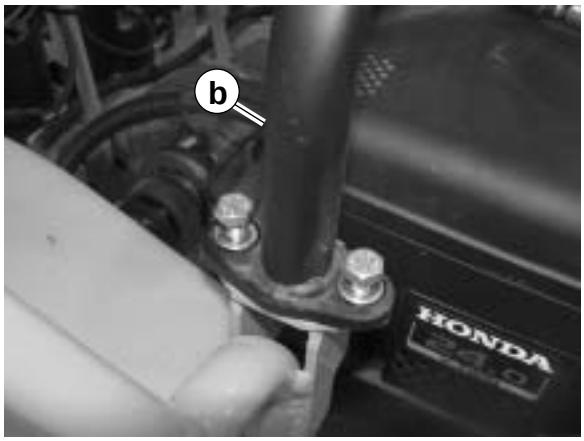
8.15.10 Open the fuel valve on the fuel tank.

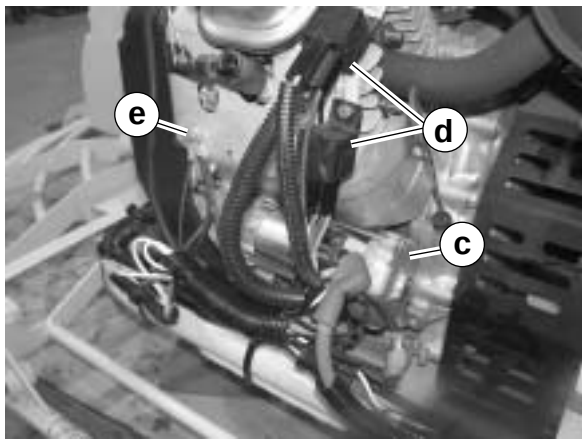
8.15.11 Reinstall the drive belt. See section *Belt Replacement*.

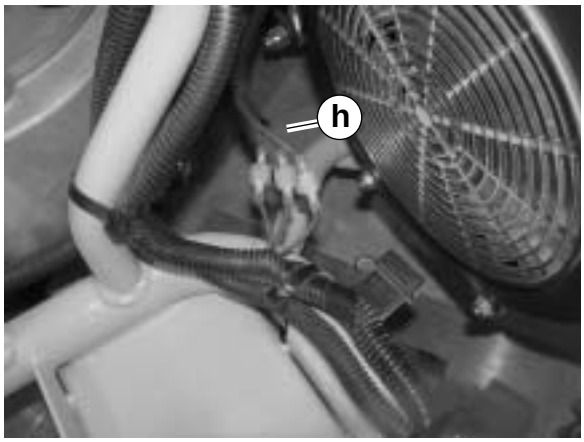
8.15.12 Reconnect the battery.

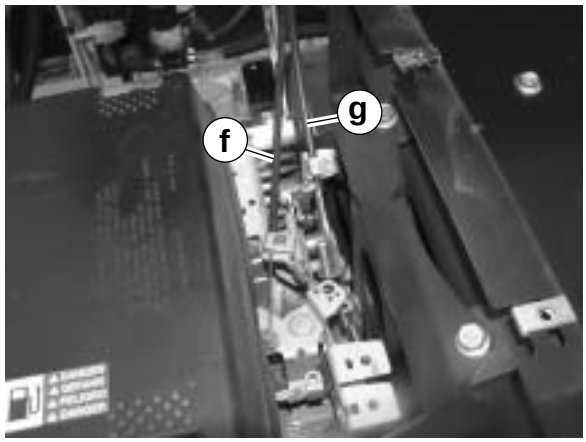












wc_gr003431

8.16 Removing the Vanguard Engine

See Graphic: wc_gr003428

This procedure requires a lift or crane capable of lifting 136 kgs. (300 lbs.).

8.16.1 Position the trowel on a flat surface.

8.16.2 Disconnect the battery.

8.16.3 Close the fuel valve on the fuel tank.

8.16.4 Remove the drive belt. See section *Belt Replacement*.

8.16.5 Remove one of the screws that secures the cross brace **(a)** and swing the cross brace out of the way.

8.16.6 Unplug the wires from the ignition modules **(b)**.

8.16.7 Unplug the oil pressure switch **(c)**.

8.16.8 Unplug the anti-backfire solenoid **(d)**.

8.16.9 Disconnect the wiring from the alternator **(e)**.

8.16.10 Disconnect the wiring from the starter motor and the starter solenoid **(f)**.

8.16.11 Disconnect the wiring at connector **(g)**.

8.16.12 Disconnect the fuel line **(h)** at the carburetor.

8.16.13 Disconnect the throttle **(i)** and the choke cable **(j)**.

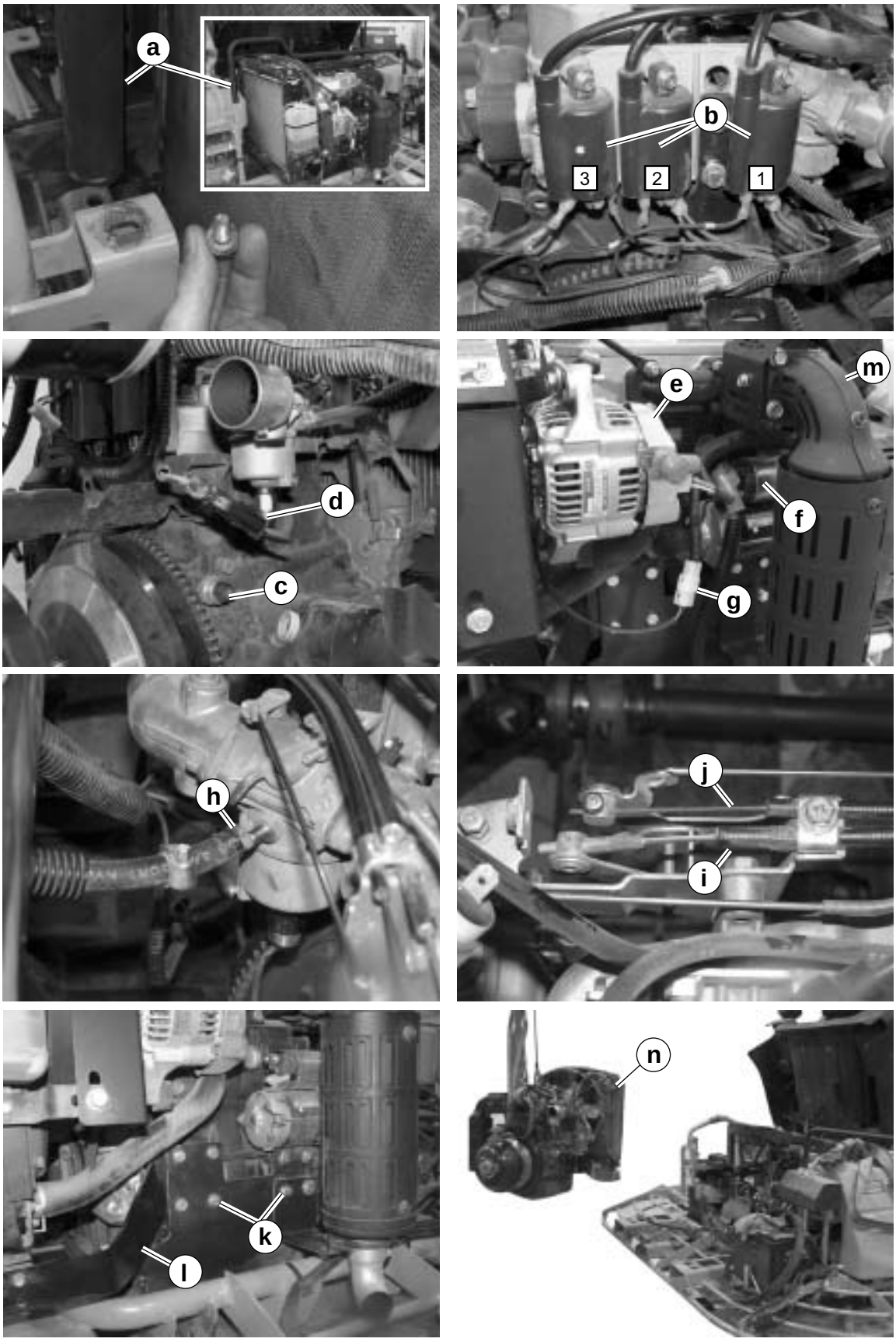
8.16.14 Unplug the temperature sender wire.

8.16.15 Cut tie wraps as needed.

8.16.16 Disconnect the ground cable from the engine (if not already done when removing belt guard).

8.16.17 Remove the screws **(k)** on each side of the engine that secure the engine to the cradle. Remove the radiator brackets **(l)** if need be. Loosen the muffler **(m)** at the manifold if need be.

8.16.18 Using an appropriate lift or crane, lift the engine **(n)** from the machine.



wc_gr003428

8.17 Installing the Vanguard Engine

See Graphic: wc_gr003428

This procedure requires a lift or crane capable of lifting 136 kgs. (300 lbs.).

8.17.1 Using an appropriate lift or crane, lower the engine **(n)** into the machine.

8.17.2 Secure the engine to the cradle with the screws **(k)** on each side of the engine. Install the radiator brackets **(l)** if removed. Tighten the muffler **(m)** at the manifold if loosened during engine removal.

8.17.3 Connect the temperature sender wire.

8.17.4 Connect the throttle **(i)** and choke cable **(j)**.

8.17.5 Connect the fuel line **(h)** at the carburetor.

8.17.6 Connect the wiring at the connector **(g)**.

8.17.7 Connect the wiring to the starter motor and the starter solenoid **(f)**.

8.17.8 Connect the wiring to the alternator **(e)**.

8.17.9 Connect the anti-backfire solenoid **(d)**.

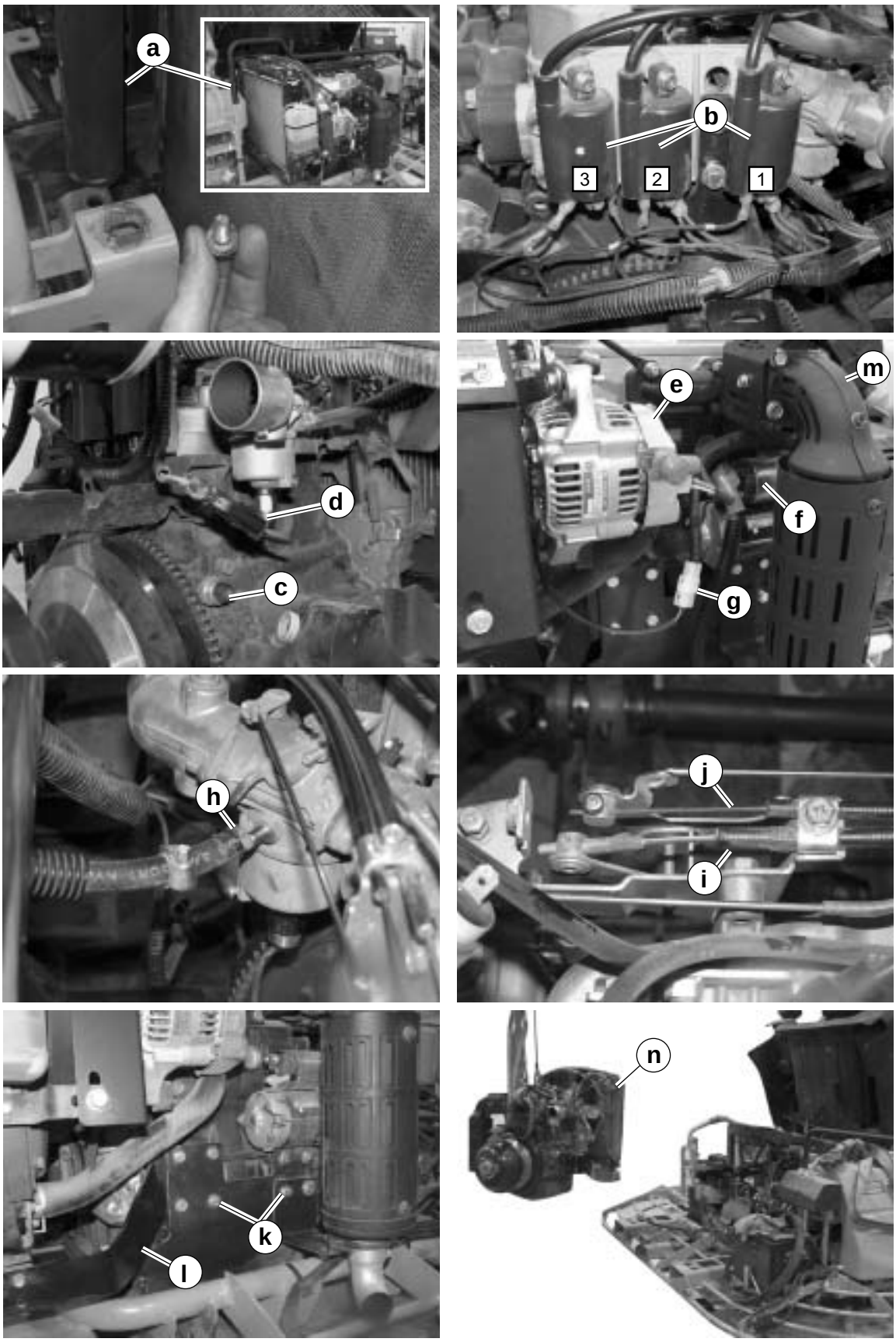
8.17.10 Connect the oil pressure switch **(c)**.

8.17.11 Connect the wires to the ignition modules **(b)**.

8.17.12 Secure all the wiring with tie wraps as needed.

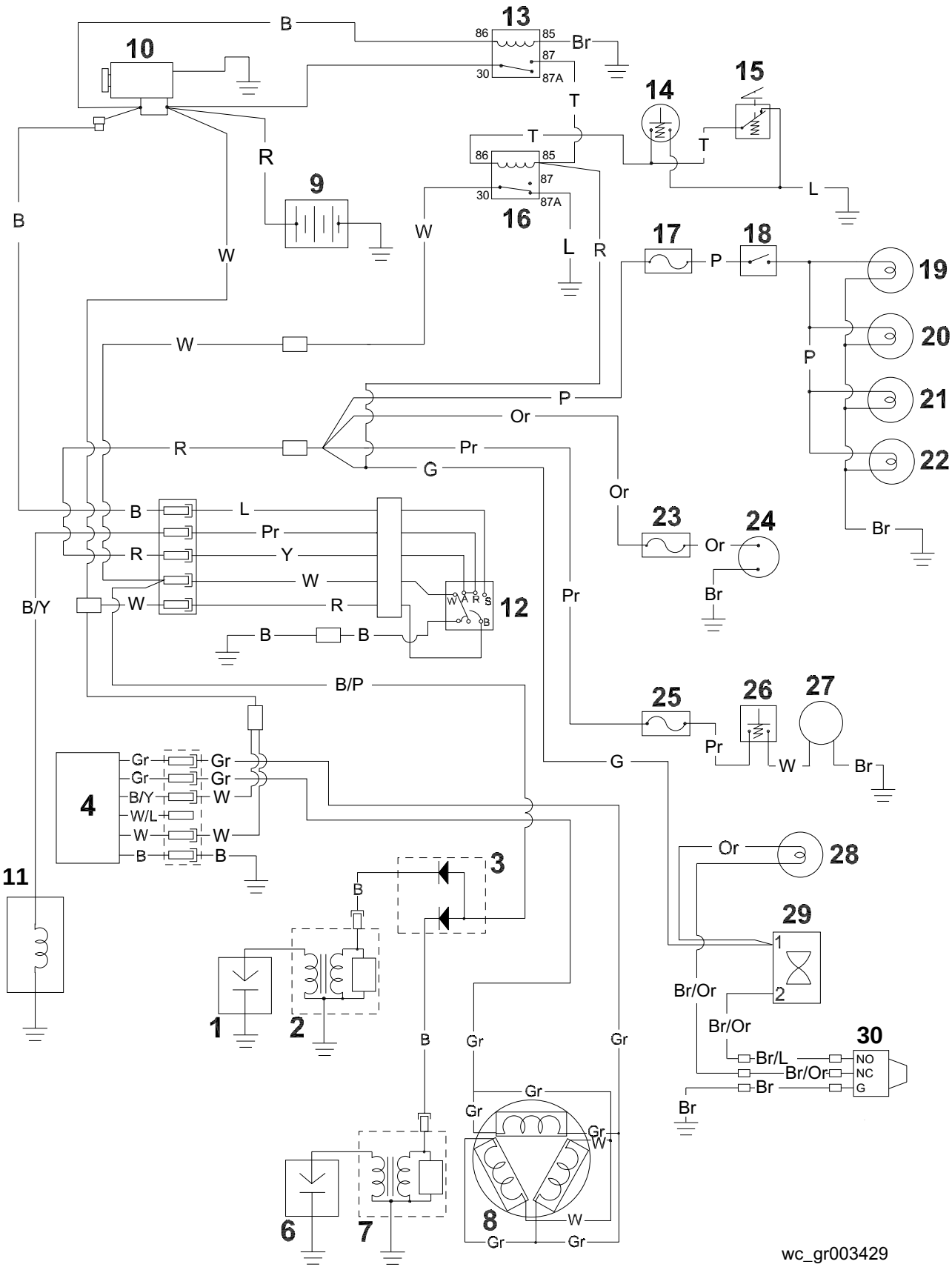
8.17.13 Secure the cross brace **(a)**.

8.17.14 Install the drive belt. See section *Belt Replacement*.



wc_gr003428

8.18 Wiring Schematic—Honda

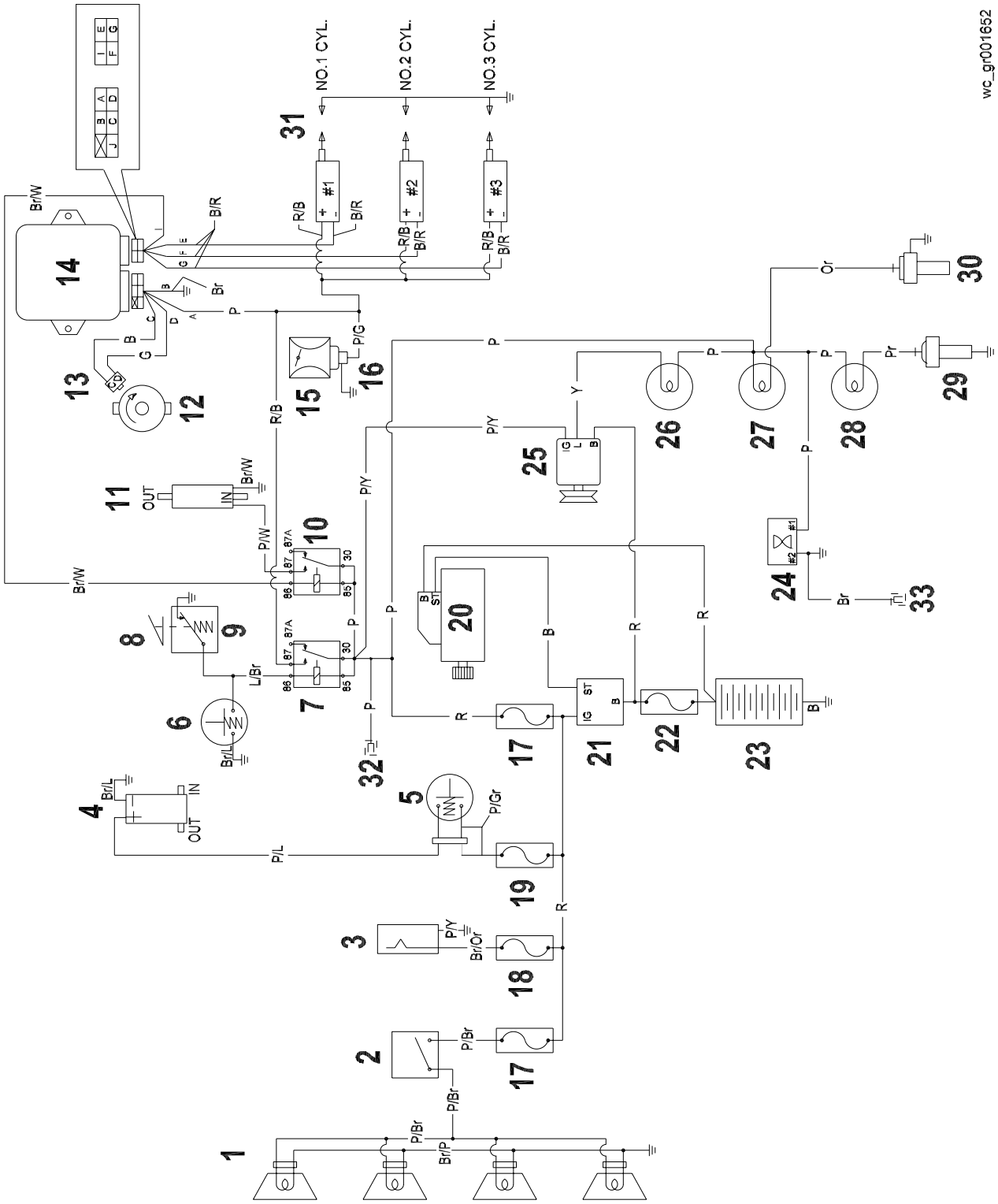


Honda Motor

Ref.	Description	Ref.	Description
1	Spark plug (right)	16	Relay—safety system
2	Coil-ignition (right)	17	Fuse 15A—light circuit
3	Engine stop diode	18	Light switch
4	Regulator/rectifier	19	Left front light
-	---	20	Left rear light
6	Spark plug (left)	21	Right front light
7	Coil-ignition (left)	22	Right rear light
8	Charging coil—20 Amp	23	Fuse 20A—accessory outlet
9	Battery	24	Accessory outlet
10	Starter motor	25	Fuse 5A—spray system
11	Fuel cut-off solenoid	26	Spray pump switch
12	Key switch	27	Spray pump motor
13	Starter relay	28	Oil pressure indicator light
14	Operator presence switch (normally open)	29	Hour meter
15	Throttle sense switch (normally closed)	30	Oil pressure switch (dual circuit)

Wire Colors							
B	Black	R	Red	Y	Yellow	Or	Orange
G	Green	T	Tan	Br	Brown	Pr	Purple
L	Blue	V	Violet	Cl	Clear	Sh	Shield
P	Pink	W	White	Gr	Gray	LL	Light blue

8.19 Wiring Schematic-Vanguard Engine (manual steer)

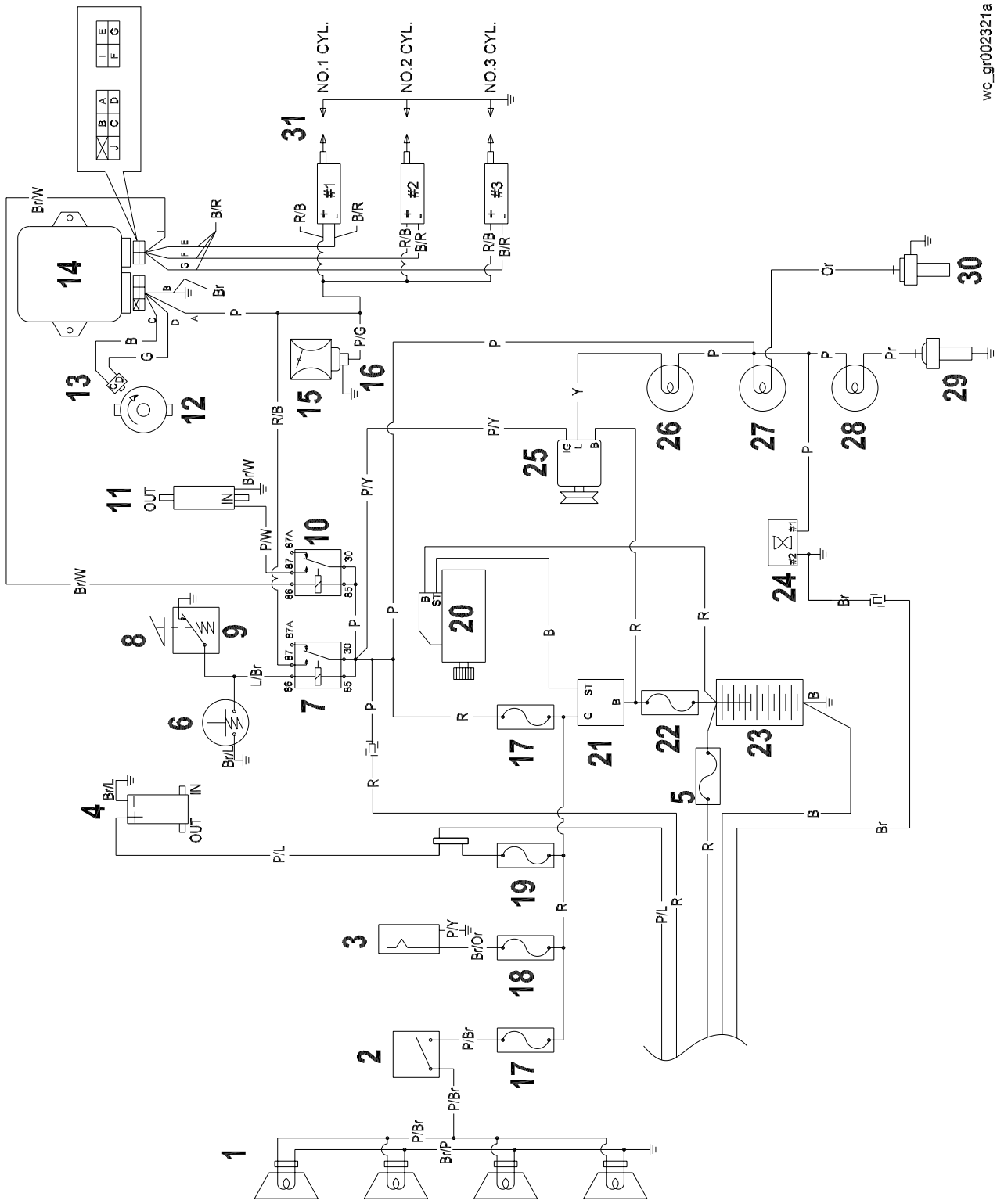


Vanguard Motor (manual steer)

Ref.	Description	Ref.	Description
1	Work lights	18	Fuse 20A
2	Light switch	19	Fuse 5A
3	DC accessory outlet	20	Starter
4	Water pump	21	Key switch
5	Sprayer pump switch	22	Fuse 50A
6	Seat switch (normally open)	23	Battery
7	Operator presence relay	24	Hour meter
8	Throttle pedal	25	Alternator
9	Throttle switch (normally closed)	26	Charging light
10	Fuel pump relay	27	Overheating warning light
11	Fuel pump	28	Oil pressure indicator light
12	Crankshaft pulley	29	Oil level switch
13	Trigger coil	30	Water temperature switch
14	Ignition module	31	Ignition coils
15	Carburetor	32	(not used)
16	Solenoid	33	(not used)
17	Fuse 15A		

Wire Colors							
B	Black	R	Red	Y	Yellow	Or	Orange
G	Green	T	Tan	Br	Brown	Pr	Purple
L	Blue	V	Violet	Cl	Clear	Sh	Shield
P	Pink	W	White	Gr	Gray	LL	Light blue

8.20 Wiring Schematic-Vanguard Engine (electric steer)

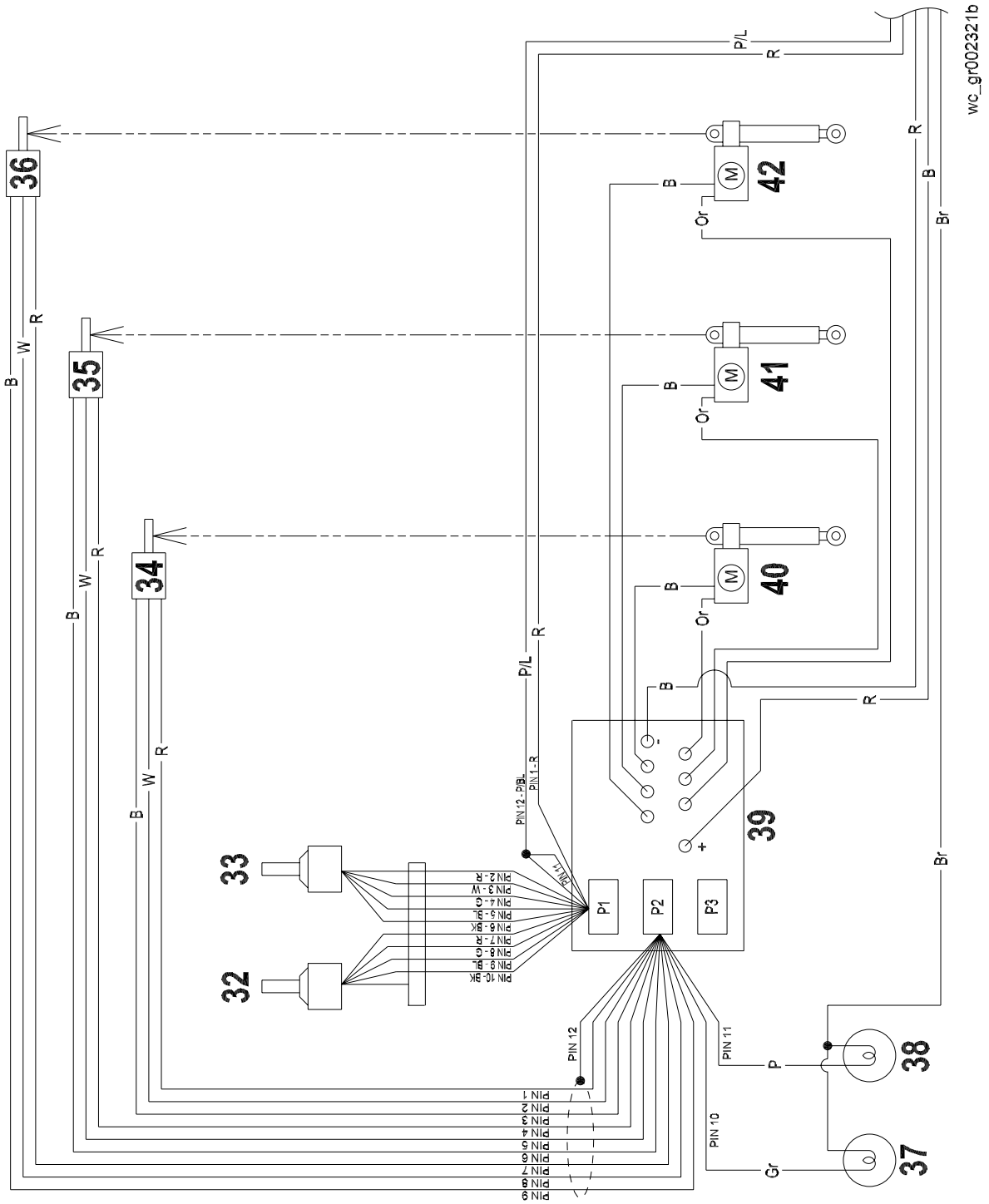


Vanguard Motor (electric steer)

Ref.	Description	Ref.	Description
1	Work lights	22	Fuse 50A
2	Light switch	23	Battery
3	DC accessory outlet	24	Hour meter
4	Water pump	25	Alternator
5	Fuse 70A	26	Charging light
6	Seat switch (normally open)	27	Overheating warning light
7	Operator presence relay	28	Oil pressure indicator light
8	Throttle pedal	29	Oil level switch
9	Throttle switch (normally closed)	30	Water temperature switch
10	Fuel pump relay	31	Ignition coils
11	Fuel pump	32	Left joystick
12	Crankshaft pulley	33	Right joystick
13	Trigger coil	34	Right load pin
14	Ignition module	35	Side load pin
15	Carburetor	36	Left load pin
16	Solenoid	37	Status OK indicator light (green)
17	Fuse 15A	38	Status error indicator light (red)
18	Fuse 20A	39	Electronic control module
19	Fuse 5A	40	Right actuator
20	Starter	41	Side actuator
21	Key switch	42	Left actuator

Wire Colors							
B	Black	R	Red	Y	Yellow	Or	Orange
G	Green	T	Tan	Br	Brown	Pr	Purple
L	Blue	V	Violet	Cl	Clear	Sh	Shield
P	Pink	W	White	Gr	Gray	LL	Light blue

Vanguard (electric steer)



Vanguard Motor (electric steer)

Ref.	Description	Ref.	Description
1	Work lights	22	Fuse 50A
2	Light switch	23	Battery
3	DC accessory outlet	24	Hour meter
4	Water pump	25	Alternator
5	Fuse 70A	26	Charging light
6	Seat switch (normally open)	27	Overheating warning light
7	Operator presence relay	28	Oil pressure indicator light
8	Throttle pedal	29	Oil level switch
9	Throttle switch (normally closed)	30	Water temperature switch
10	Fuel pump relay	31	Ignition coils
11	Fuel pump	32	Left joystick
12	Crankshaft pulley	33	Right joystick
13	Trigger coil	34	Right load pin
14	Ignition module	35	Side load pin
15	Carburetor	36	Left load pin
16	Solenoid	37	Status OK indicator light (green)
17	Fuse 15A	38	Status error indicator light (red)
18	Fuse 20A	39	Electronic control module
19	Fuse 5A	40	Right actuator
20	Starter	41	Side actuator
21	Key switch	42	Left actuator

Wire Colors							
B	Black	R	Red	Y	Yellow	Or	Orange
G	Green	T	Tan	Br	Brown	Pr	Purple
L	Blue	V	Violet	Cl	Clear	Sh	Shield
P	Pink	W	White	Gr	Gray	LL	Light blue

Notes:

Threadlockers and Sealants

Threadlocking adhesives and sealants are specified throughout this manual by a notation of “S” plus a number (S#) and should be used where indicated. Threadlocking compounds normally break down at temperatures above 175°C (350°F). If a screw or bolt is hard to remove, heat it using a small propane torch to break down the sealant. When applying sealants, follow instructions on container. The sealants listed are recommended for use on Wacker equipment.

TYPE ( ) = Europe	COLOR	USAGE	PART NO. – SIZE
Loctite 222 Hernon 420 Omnifit 1150 (50M)	Purple	Low strength, for locking threads smaller than 6 mm (1/4”). Hand tool removable. Temp. range: -54 to 149°C (-65 to 300°F)	73287 - 10 ml
Loctite 243 Hernon 423 Omnifit 1350 (100M)	Blue	Medium strength, for locking threads larger than 6 mm (1/4”). Hand tool removable. Temp. range: -54 to 149°C (-65 to 300°F)	29311 - .5 ml 17380 - 50 ml
Loctite 271/277 Hernon 427 Omnifit 1550 (220M)	Red	High strength, for all threads up to 25 mm (1”). Heat parts before disassembly. Temp. range: -54 to 149°C (-65 to 300°F)	29312 - .5 ml 26685 - 10 ml 73285 - 50 ml
Loctite 290 Hernon 431 Omnifit 1710 (230LL)	Green	Medium to high strength, for locking preassembled threads and for sealing weld porosity (wicking). Gaps up to 0.13 mm (0.005”) Temp. range: -54 to 149°C (-65 to 300°F)	28824 - .5 ml 25316 - 10 ml
Loctite 609 Hernon 822 Omnifit 1730 (230L)	Green	Medium strength retaining compound for slip or press fit of shafts, bearings, gears, pulleys, etc. Gaps up to 0.13 mm (0.005”) Temp. range: -54 to 149°C (-65 to 300°F)	29314 - .5 ml
Loctite 545 Hernon 947 Omnifit 1150 (50M)	Brown	Hydraulic sealant Temp. range: -54 to 149°C (-65 to 300°F)	79356 - 50 ml
Loctite 592 Hernon 920 Omnifit 790	White	Pipe sealant with Teflon for moderate pressures. Temp. range: -54 to 149°C (-65 to 300°F)	26695 - 6 ml 73289 - 50 ml
Loctite 515 Hernon 910 Omnifit 10	Purple	Form-in-place gasket for flexible joints. Fills gaps up to 1.3 mm (0.05”) Temp. range: -54 to 149°C (-65 to 300°F)	70735 - 50 ml

Threadlockers and Sealants

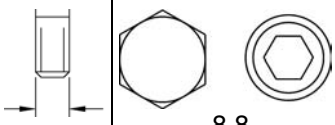
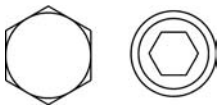
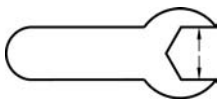
Threadlockers and Sealants (continued)

Threadlocking adhesives and sealants are specified throughout this manual by a notation of “S” plus a number (S#) and should be used where indicated. Threadlocking compounds normally break down at temperatures above 175°C (350°F). If a screw or bolt is hard to remove, heat it using a small propane torch to break down the sealant. When applying sealants, follow instructions on container. The sealants listed are recommended for use on Wacker equipment.

TYPE ( ) = Europe	COLOR	USAGE	PART NO. – SIZE
Loctite 496 Hernon 110 Omnifit Sicomet 7000	Clear	Instant adhesive for bonding rubber, metal and plastics; general purpose. For gaps up to 0.15 mm (0.006”) Read caution instructions before using. Temp. range: -54 to 82°C (-65 to 180°F)	52676 - 1oz.
Loctite Primer T Hernon Primer 10 Omnifit VC Activator	Aerosol Spray	Fast curing primer for threadlocking, retaining and sealing compounds. Must be used with stainless steel hardware. Recommended for use with gasket sealants.	2006124-6 oz.

Torque Values

Metric Fasteners (DIN)

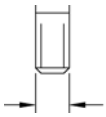
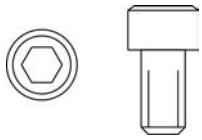
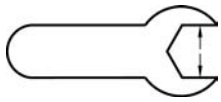
	TORQUE VALUES (Based on Bolt Size and Hardness)						**WRENCH SIZE**			
	 8.8		 10.9		12.9					
Size	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Metric**	**Inch**	**Metric**	**Inch**
M3	1.2	*11	1.6	*14	2.1	*19	5.5	7/32	2.5	–
M4	2.9	*26	4.1	*36	4.9	*43	7	9/32	3	–
M5	6.0	*53	8.5	6	10	7	8	5/16	4	–
M6	10	7	14	10	17	13	10	–	5	–
M8	25	18	35	26	41	30	13	1/2	6	–
M10	49	36	69	51	83	61	17	11/16	8	–
M12	86	63	120	88	145	107	19	3/4	10	–
M14	135	99	190	140	230	169	22	7/8	12	–
M16	210	155	295	217	355	262	24	15/16	14	–
M18	290	214	405	298	485	357	27	1-1/16	14	–
M20	410	302	580	427	690	508	30	1-1/4	17	–

1 ft.lb. = 1.357 Nm * = in.lb. 1 inch = 25.4 mm

Torque Values

Torque Values (continued)

Inch Fasteners (SAE)

										
Size	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Metric**	**Inch**	**Metric**	**Inch**
No.4	0.7	*6	1.0	*14	1.4	*12	5.5	1/4	–	3/32
No.6	1.4	*12	1.9	*17	2.4	*21	8	5/16	–	7/64
No.8	2.5	*22	3.5	*31	4.7	*42	9	11/32	–	9/64
No.10	3.6	*32	5.1	*45	6.8	*60	–	3/8	–	5/32
1/4	8.1	6	12	9	16	12	–	7/16	–	3/32
5/16	18	13	26	19	33	24	13	1/2	–	1/4
3/8	31	23	45	33	58	43	–	9/16	–	5/16
7/16	50	37	71	52	94	69	16	5/8	–	3/8
1/2	77	57	109	80	142	105	19	3/4	–	3/8
9/16	111	82	156	115	214	158	–	13/16	–	–
5/8	152	112	216	159	265	195	24	15/16	–	1/2
3/4	271	200	383	282	479	353	–	1-1/8	–	5/8

1 ft.lb. = 1.357 Nm * = in.lb. 1 inch = 25.4 mm

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